Plan Vivo Project Design Document (PDD)

MIKOKO PAMOJA
Mangrove conservation for community benefit

2020 revision

Executive Summary

This Project Design Document (PDD) is being submitted by the Association of Coastal Ecosystem Services (ACES), on behalf of the Mikoko Pamoja Community Organisation, hereinafter referred to as MPCO, who are the owners of the carbon credits derived from the Mikoko Pamoja project.

A community-led project in Gazi Bay, Kenya (4o 25'S and 39o 50'E) will protect 107 ha of natural mangrove forest and 10 hectares of plantation as well as planting an additional 2000 trees annually, over a period of 20 years.

Carbon benefits are conservatively estimated at 2500 tonnes CO2 yr^{-1}, derived from avoided deforestation, prevented forest degradation and new planting.

Because mangroves provide a wide range of other ecosystem services, including coastal protection, nursery habitat for fish and water purification, preserving and restoring these forests will have multiple additional benefits that are not accounted for here.

All income from the sale of Plan Vivo Certificates from Mikoko Pamoja (MP) will be invested in local projects determined through community consultation (as well as in project coordination and administration). The Mikoko Pamoja Community Organization (MPCO) consists of representatives of Gazi Bay, specifically Gazi and Makongeni villages, and expenditure will benefit people in those areas. The Mikoko Pamoja Steering Group (MPSG - which will provide technical support for MPCO) consists of staff from the Kenya Marine and Fisheries Research Institute (KMFRI), Kenya Forest Service (KFS), a representative of the Tidal Forests of Kenya Project and a representative of the MP community organization. The Association for Coastal Ecosystem Services (ACES) is a charity registered in Scotland that will facilitate the transfer of international funds and report to the Plan Vivo Foundation.

There are three Plan Vivo project activity areas referred to in this document:

Activity area 1: *Rhizophora mucronata* forest
Activity: Avoided deforestation and forest restoration
107 ha of mangrove forest (divided into two sub-areas) will be protected.

Activity area 2. *Rhizophora mucronata* plantations
Activity: Reforestation and forest protection
10 ha of existing plantation (consisting of two separate areas) will be protected.

Activity area 3. New *Sonneratia alba* plantation on a degraded beach
Activity: Reforestation of eroded beach area
0.4 ha of degraded shoreline that used to support Sonneratia alba will be replanted annually. 8 ha will be planted in total. Sonneratia alba is a native species.

Contents

List of abbreviations

°C	Degree Celsius
ACES	Association for Coastal Ecosystem Services
AGB	Above Ground Biomass
BGB	Below Ground Biomass
C	Carbon
CDM	Clean Development Mechanism
CFA	Community Forest Association
CO2	Carbon dioxide
DBH	Diameter at Breast Height
DFID	Department for International Development
EAWLS	East Africa Wildlife Society
EIA	Environment Impact Assessment
EMCA	Environmental Management & Coordination Act
FAO	Food and Agriculture Organization
GEF	Global Environmental Fund
GoK	Government of Kenya
GPS	Global positioning system
ha	Hectares
IGA	Income Generating Activity
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KCFCF	Kenya Coastal Forest Conservation Forum
KFS	Kenya Forest Services
KMFRI	Kenya Marine & Fisheries Research Institute
KNBS	Kenya National Bureau Statistics
NGO	Non-Governmental Organization
PC	Project Co-ordinator
PDD	Project Design Document
PES	Payment for Ecosystem Services
PFMP	Participatory Forest Management Plan
PV	Plan Vivo
PVC	Plan Vivo Certificate
REDD+	Reducing Emission from Deforestation and Forest Degradation
SDG	Sustainable Development Goals
SEAs	Strategic environmental assessments
SLR	Sea Level Rise
UK	United Kingdom
UNEP	United Nation Environment Program
USD	United States Dollar
VCS	Voluntary Carbon Standards
WIO TDA	Western Indian ocean transboundary Diagnostic Analysis
WWF	World Wide Fund

List of tables

List of figures

Conversion table

1 Hectare (ha) = 10,000 square metre (m2)
1 Tonnes (t) = 1 Megagram (1 Mg)
1CO2 = 1CO2e

Definition of terms

Additionality
Whether an emissions reduction or removal would have occurred in the absence of new incentives, such as a payment for emissions reductions.

Afforestation
Direct human-induced conversion of land that has not been forest for a period of at least 50 years to forest through planting, seeding and/or human-induced promotion of natural seed sources.

Baseline scenario
Conditions that are expected to occur in the absence of any project intervention.

Carbon pool
A system that can store and/or accumulate carbon.

Carbon sequestration
Direct removal of carbon dioxide from the atmosphere and storage in a carbon pool in forests or in soils (biological sequestration only).

Ecosystem services
The benefits people obtain from the environment. They are classified as provisioning, regulating, cultural, or supporting, that maintain the conditions for life on Earth.

Forest
Land containing a vegetation association dominated by trees of any size whether exploitable or not, capable of producing wood or other products, potentially capable of influencing climate, excising an influence on the soil, water regime and providing habitat for wildlife.

Leakage
The unintended increase in GHG emissions or decrease in carbon stocks outside project intervention areas, which is attributable to the project and results in a lower provision of climate services being attributable to the project.

PES or Payments for Ecosystem Services
A model for compensating or incentivising individuals or groups for management activities that generate ecosystem services, by providing staged, performance-related cash or in-kind payments or rewards.

REDD+
Reducing Emissions from Deforestation and Forest Degradation, and the role of Conservation, Sustainable Forest Management and Enhancement of Carbon Stocks.

Reforestation
The direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was previously forested but that has been converted to non-forested land.

Part A: Aims and objectives

Mikoko Pamoja is a community-led mangrove conservation and restoration project based in southern Kenya. Its aim is to provide long-term incentives for mangrove protection and restoration through community involvement and benefit. Its objectives are:

1) To **facilitate community development** in the Gazi Bay area by using funds raised from the sale of Plan Vivo Certificates for projects of collective benefit agreed by local people.

2) To **restore degraded and denuded mangrove ecosystems** in Gazi Bay through community policing of illegal mangrove harvesting and the application of local expertise in the planting of mangrove seedlings.

3) To **generate carbon benefits** of 2482 tCO2 yr-1 along with a wide range of associated ecological benefits including improved fisheries wildlife habitat and coastal protection.

4) To **promote sustainable mangrove related Income Generating Activities (IGA)** such as beekeeping and ecotourism.

5) To **act as a demonstration project showing the feasibility and desirability of community-led mangrove conservation with carbon credit funding** and thus influence national and regional policy.

Part B: Site Information

B1. Project location and boundaries

The project area is Gazi Bay, Kenya (4o 25'S and 39o 50'E; Figure 1). Gazi bay is situated on the south coast of Kenya, some 50 km from Mombasa, in the Msambweni District of Kwale County (Figure 1).

The 615 ha of mangrove forest at Gazi bay is the best-studied mangrove ecosystem in Africa, and amongst the best known in the world (see e.g. Bosire et al., 2008; Huxham et al., 2015; J G Kairo et al., 2009; James G. Kairo, Lang'at, Dahdouh-Guebas, Bosire, & Karachi, 2008) There is a long history of community participation in and support for mangrove research and restoration (Kairo, 1996) and Gazi village hosts a field station run by the Kenya Marine and Fisheries Research Institute (KMFRI) which specialises in mangrove research.

Figure 1. The project area. Image taken from Sentinel 2 February 2019

Key	Activity area	Baseline land cover type	Activity
Blue outline	Activity area 1	*Rhizophora mucronata* forest	Avoided deforestation and forest restoration: *Rhizophora mucronata* forest
Red outline	Activity area 2	*Rhizophora mucronata* plantations	Reforestation and forest protection: *Rhizophora mucronata* plantations
Yellow outline	Activity area 3	Degraded former *Sonneratia* forest	Reforestation of eroded beach area: *Sonneratia alba* plantation

B2. Description of the project area

Gazi Bay is sheltered from strong waves by the Chale Peninsula to the east and a fringing coral reef to the south. Two seasonal rivers, Kidogoweni and Mkurumudji, drain into the bay and groundwater seepage is restricted to a few points. Total annual precipitation (1000-1600

mm) falls mainly in two rainy seasons (April-August and October-November). Air temperature is 24-39oC and relative humidity averages 95%. All the areas relevant to this proposal lie between mid-tidal and spring high-tidal levels, that is between 1 and 4 metres above sea level (the spring tidal range is ~4.0 m). Sediment in these areas ranges from sand through to fine muddy silt. All the nine species of mangroves occurring in Kenya are found in Gazi bay; the dominant species (and the most important one for this specification) is *Rhizophora mucronata*. *Sonneratia alba* is the only species capable of tolerating the exposed beach conditions found to the south east of the bay, close to Gazi village, and this species will be used for project activities there (in activity area 3, *Sonneratia alba* plantation on open beach). Although none of the species are globally threatened, the mangrove ecosystem itself is widely considered to be of global importance and to have a high conservation priority, not least because of the rapid global rates of mangrove destruction.

The villages of Gazi and Makongeni are located close to the Ukunda-Ramisi Road and so benefit from relatively easy road access. The closest airport is at Ukunda (17km) with a larger airport at Mombasa (48km). Both villages are therefore relatively accessible. The road network is, however, prone to flooding during the rainy seasons. A telephone mast located in Gazi provides the area with good telephone and mobile internet connections. Electricity is available in Gazi, but less widely available in Makongeni. Flooding during rainy seasons is a frequent climate mediated hazard in the area.

B3. Recent changes in land use and environment conditions

Mangroves of the area are exploited for wood and non-wood resources. About 87% of the population living within or adjacent to the mangroves of Vanga depends on mangroves for building and energy. Changes in land-use practices upstream impact directly/indirectly on the mangrove ecosystem downstream. Further, the communities of Gazi Bay have witnessed a rise in human population that has increased the demand for marine resources including mangroves.

Analysis of Landsat data from the project area shows a decrease of mangrove forest cover over time. Overall, the area of mangroves in Gazi and across the south coast have declined on average by 0.7 % yr^{-1} over the period 1985 – 2010, as shown in (Kirui et al., 2013b)**,** although these losses in Gazi have been prevented since 2012 and the launch of Mikoko Pamoja.

B4. Drivers of degradation

Globally, major changes in mangrove coverage are a result of both climate change and anthropogenic stressors. The Western Indian Ocean region has witnessed increased frequency and intensity of weather events such as flooding and storm surges. Consequently, these have contributed to mangrove die-backs as a result of increased sedimentation and habitat degradation. The root causes of loss and degradation of mangrove forests in Kwale county have been identified during stakeholder analysis exercises (Figure 2).

Drivers of losses and degradation of mangroves in the project area have been identified as population pressure, poverty and inequality, and poor governance. Poor governance manifests itself through illegal harvesting, forest encroachment and weak enforcement of existing laws. Social economic impacts of losses and degradation include loss of community livelihoods, declining fish stocks and shortage of harvestable wood products. Quantitative modelling of the drivers of mangrove loss across Kenya by the project team identify similar factors nation- wide.

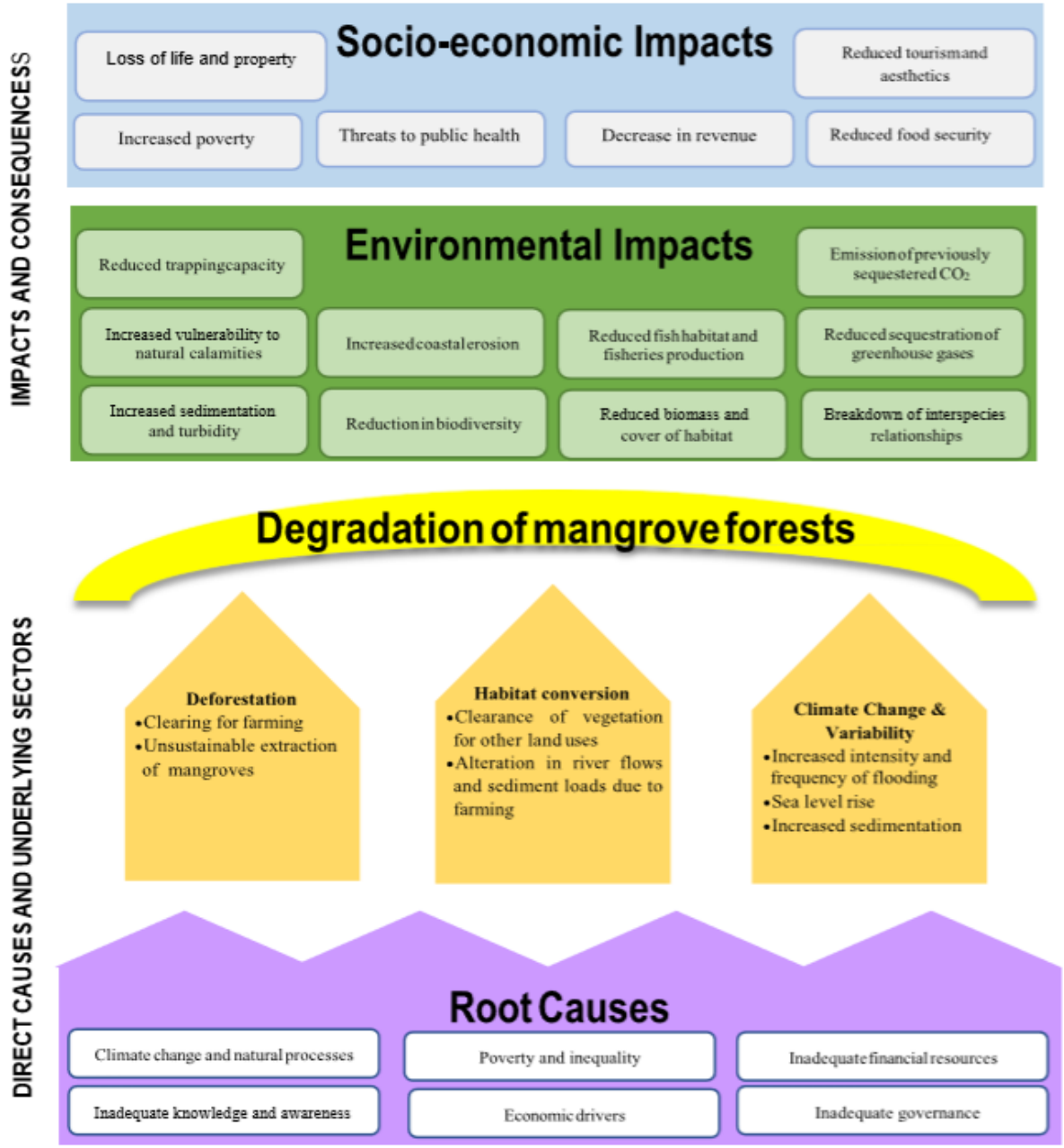

Figure 2: Problem tree of degradation of mangroves in Vanga (Source: Adopted from UNEP, 2009)

As a natural forest the mangroves of Gazi Bay have been present for millennia. However they have suffered degradation and, in some areas, total destruction, common with most mangrove areas in Kenya. The average rate of forest loss nationally is 0.27% per annum (as determined by remote sensing work by the project team; (Kirui et al., 2013), but this does not include degradation which is the main way in which forest carbon stocks are reduced. There are some large clear-cut areas dating from the 1970s and which have not shown natural regeneration; we will be replanting one of these areas building on expertise in nursery and plantation establishment techniques developed at the site. There has been a range of experimental plantations developed since the early 1990s by KMFRI staff that has tested the best ways in which to plant and nurture trees here. Hence we can build on this site-specific expertise.

The main current uses of the large natural forest area are for fishing, extraction of fuel wood,

and tree harvesting for building (both legal and illegal).

Part C: Community and Livelihoods Information

C1. Describe the participating communities/groups

The project will involve the residents of the Gazi Bay area. In particular this involves the two largest villages in the area, Gazi and Makongeni, where representatives of the MPCO will be based. These community representatives will also represent people in the administrative areas surrounding the villages. The combined population of the two villages is approximately 5400 persons; with Gazi village having 60% of this total. The main ethnic group in the vicinity is Digo and a large majority of people are Muslims.

Inequalities in wealth and power exist between people in the area (as they do in all human communities); women have traditionally held less influence than men. The MPCO is sensitive to this and will require a minimum of 40% representation by women.

C2. Describe the Socio-economic context

Many households (76% according to a 2017 social survey) rely on open fires (three stone) as their main source of energy. Of these, 28% report using mangrove wood as fuel.

Prior to the establishment of Mikoko Pamoja, freshwater available to the community was largely brackish. In 2016, Mikoko Pamoja financed the construction of wells and water points that are now used by 73% of the community. 75% of these users live in Gazi and 25% in Makongeni; this is due to the widely distributed nature of Makongeni village making it difficult for water points to be constructed within walking distance of all residents.

Local people rely heavily on natural resources, in particular on fisheries. The artisanal fishery is based on finfish, with seine netting, gill netting and spear fishing used to catch larger species such as *Lethrinidaea, Lutjanidae* and *Sphyraenidae*. Crustaceans and molluscs are also caught, especially by women and children. There has been rapid growth in Gazi and around one third of households are recent immigrants from Tanzania. In addition to fishing, people rely on mangrove resources, including fuelwood and building poles, and conduct a range of other activities such as small scale farming, retail and tourism (including welcoming visitors to a mangrove boardwalk). Around one quarter of households also receive remittances from kin living and working outside the area.

Activity area 1 (the natural Rhizophora dominated forest) is currently used by local people for fishing, particularly for crustaceans, and for the extraction of forest goods (including legal and illegal removal of firewood and poles). In addition it is used for legal cutting by the concessionaire as one area of the forest from which he takes his current annual quota of 500 scores of poles per year. Activity area 2 (the *Rhizophora* plantation) is used by fishers and suffers poaching of poles. Activity area 3 (the beach) is used by local women for collecting molluscs and firewood from dead trees and branches.

C3. Describe land tenure & ownership of carbon rights

Mangrove forests in Kenya are owned by the government. Responsibility to manage forests in Kenya is bestowed to the KFS. Through the Community Forest Association, the Gazi

community will sign a user agreement with KFS, allowing the community to utilize designated mangrove areas for MPCO.

Casuarina woodlots have been established on community land. Initially 1.5ha of Casuarina has been established in Gazi and Makongeni School grounds and a Memorandum of Understanding signed between the communities and the schools on how the trees will be managed. These woodlots are there to provide long-term sources of fuelwood and building poles for local people as part of the leakage mitigation strategy for MP. It is envisaged they will also provide income for the project. They are not part of the carbon benefit activities and will not be used for issuing carbon certificates.

Despite mangroves qualifying for REDD+, there are no plans yet to include the project area in the national REDD+ scheme for Kenya. Furthermore, mangroves and associated blue carbon ecosystems have not been incorporated into Kenya's Nationally Determined Contributions (NDC) of Paris Agreement; as such there is no infringement of community rights to transact in ecosystem services. The project team are well connected with the relevant civil servants and departments and are working with them on the implications of NDCs for community projects.

Part D: Project Interventions & Activities

D1. Summarise the project interventions

MPCO is committed to protecting and sustainably managing mangrove forests for continued supplies of their goods and services in the project area. Two main interventions are proposed in this PDD: forest protection and forest restoration. These are discussed in detail in Part F of the PDD. Additionally, broader community interventions that are not eligible for offset carbon will be implemented as follows:

- Community woodlots and avoidance of leakage where participating communities will be trained on establishment of nurseries and plantations of fast-growing tree species and use of energy-saving stoves would be promoted to enhance efficiency and reduce carbon emissions. In partnership with relevant agencies, we will explore promotion of sustainable agricultural activities in areas adjacent mangroves through provision of training and extension services.

- Socio-economic development: In addition, money transferred into the community fund, generated by the sale of carbon credits, will be spent for community benefits. Specific projects supported through MPCO will depend on democratic decisions taken by the community, but may include access to clean water, improved educational facilities, mangrove conservation, improved health services and other community projects.

- Voluntary seagrass management: Gazi Bay contains extensive yet vulnerable seagrass meadows, primarily of the species *Thalassodendron ciliatum, Thalassia hemprichii, Enhalus acoroides and Syringodium isoetifolium*. Human activities including fishing, particularly seine netting, can damage and destroy seagrasses and evidence shows that seine netting has had a negative impact on seagrasses in Gazi Bay (Harcourt et al., 2018).

  A voluntary seagrass management area is in the process of being designated in Gazi Bay to restrict the use of fishing gear known to damage seagrass. The development of this seagrass management area is being led by the MPCO team and has to date

included a full stakeholder consultation involving the local fishing community of Gazi Bay. Final boundaries are, at the time of writing (December 2019), still to be finalised, however it is anticipated that the conservation area will initially cover 200ha.

It is not expected that the protected seagrass will become eligible for PVCs due to technical and financial challenges in monitoring and a low anticipated income from seagrass carbon. Instead, it is planned that the income to fund seagrass management will be generated under a 'carbon plus' model, under which buyers of PVCs will have the option to pay an additional donation to fund the management measures. The suggested donation will be based on carbon calculations assuming 1.38 tC/ha year^{-1} burial, based on the synthesis by (Mcleod et al., 2011), however wider ecosystem services including coastal protection, fisheries enhancement and biodiversity will be emphasised to buyers. This additional income will be used for community benefit projects directed at the stakeholders affected by the seagrass management measures, primarily fishers.

D2. Summarise the project activities for each intervention

Table 1. Description of activities

Intervention type		**Project Activity**	**Target group**	**Eligible for PV accreditation**
Forest Protection	Enhancement of Carbon Stock	• Increased surveillance • Enhanced community education and awareness and the need to protect them	MPCO, KFS, KMFRI	Yes
	Avoided deforestation	• Enforcement of forest laws and regulations; • Involving local community in regular forest monitoring	MPCO, KFS	Yes
Forest restoration	Ecosystem rehabilitation	• Initiate community based ecological Mangrove restoration • Monitoring of natural regeneration	MPCO, KFS, KMFRI	Yes
	Reforestation	• Protecting and monitoring of 10-year-old mangrove stands	MPCO, KFS	Yes
Others	Improved	• Establishment of	MPCO,	No

	forest management and avoidance of leakage	woodlots of fast-growing species such as Casuarina equisetifolia; • Use of energy-saving stoves	Community farmers	
	Socio-economic development	• Support local development projects in education, water and sanitation and environmental conservation	Community groups	No
	Seagrass conservation	• Establishment of voluntary MPA to control destructive fishing	Beach Management Unit, Community Groups	No

D3. Effects of activities on biodiversity and the environment

The project will have a range of beneficial effects on the local environment and local ecosystems. In particular by protecting and restoring mangrove forests it will benefit the wide range of species naturally associated with mangroves. We do not anticipate any negative environmental effects.

In addition to the activities for which carbon benefit is quantified, woodlots of *Casuarina equisitifolia* trees will be established on community land. As part of the leakage mitigation plan, the Casuarina woodlots will provide fuelwood and timber for local people and a sustainable source of income for the community fund.

We propose to use this non-native but naturalised species because:

a) It is already widely present along the coast, both in commercial (small scale) plantations and as wild (naturalised) trees.

b) There is expertise and local resources available to support its growing. A number of villagers already have trees growing on their smallholdings and thus have the knowledge to grow the trees and the networks of suppliers and nurseries to support them. Casuarina is the species requested by the users of the woodlot and the local community.

c) It grows very fast and produces poles that can be used to replace wood normally harvested from mangroves for building as well as providing brush for firewood.

The woodlots have been established near the Gazi and Makongeni school grounds, on community land. Hence these areas are already agricultural/urban land with no conservation interest. The water table is close to the surface and water is abundant. There are freshwater seeps on the beach and the rainfall is more than 1000 mm per year. Hence we are confident that these relatively small plantations will not affect the water table and will have no detrimental impacts on conservation or wildlife.

Table 2. Summary of expected impacts of project activities on key environmental services

Activity Areas	Biodiversity impacts	Water availability/watershed impacts	Soil productivity/conservation impacts	Other
Rhizophora mucronata forest protection (activity area 1)	Restoration of high-quality natural mangrove forest will benefit all the resident mangrove fauna and flora	N.A.	Loss of mangroves causes erosion and subsidence – conservation will enhance coastal protection and sediment stability	All relevant mangrove ecosystem services, including fisheries provision and sediment capture, will be enhanced
Rhizophora mucronata plantation protection (activity area 2)	Protection of mangrove plantation will benefit all the resident mangrove fauna and flora and allow natural successional processes to occur	N.A.	Loss of mangroves causes erosion and subsidence – conservation will enhance coastal protection and sediment stability	All relevant mangrove ecosystem services, including fisheries provision and sediment capture, will be enhanced
Sonneratia alba plantations (activity area 3)	This formerly forested area has become an eroding beach. Tree replanting will help restore biodiversity	The coastal strip is suffering saltwater intrusion; a restored mangrove forest will help prevent this	Coastal erosion is severe in this area and will be mitigated or prevented by mangrove planting	This area is important for a range of coastal birds including bee-eaters and orioles that will benefit from forest expansion

Part E: Community participation

E1. Participatory project design

A participatory approach has been used whereby the community (including women and youth) were involved in every step of the project design and planning. Technical support was provided by KMFRI through community trainings on joint mangrove management approaches and the management of carbon offset projects in forestry.

The initial establishment of Mikoko Pamoja has involved community consultations and barazas (open village meetings) in Gazi and Makongeni, participatory appraisal exercises involving local people in ranking priorities and considering risks and high-profile recruitment exercises for the community organisation representatives.

E2. Community-led implementation

The project targets residents of Gazi and Makongeni villages. MPCO is the vehicle through which the communities will co-manage the mangroves of the project area. Development of the project was preceded by a series of consultative meetings and open forums with communities at Gazi and Makongeni. Appraisal surveys have been used in ranking priority community projects as well as in identifying risks and members of implementation committees from each village. Implementation of the project would be vested with the MPCO team. A qualified Project Coordinator (PC) is responsible for day to day running of the project according to the workplan. The PC is be trained on coordination and reporting procedures and is responsible for reporting of project activities. Information on how much carbon funds has been generated flows from the coordinator to the committee and lastly to the community members through village barazas and also displayed on strategic located village notice boards.

E3. Community-level project governance

The project has grown out of a long-term involvement by KMFRI in leading mangrove restoration and conservation projects for more than twenty years at the site. KMFRI have a regional office based in Gazi and support a staff of ten people living and working there. Technical support for the project comes in addition from scientists from organisations based outside of Kenya, including Edinburgh Napier University, Bangor University and Earthwatch Institute, all of whom have worked with KMFRI on mangrove projects at the site for the past nine years.

Hence there is a long track-record of involvement by project partners with local people. Community liaison and engagement groups, including the Earthwatch-Gazi Community Committee, the Mangrove Women's Boardwalk Committee and Youth group, have helped set fund-raising priorities and direct development efforts towards collectively agreed projects including school buildings and pumps for wells. The Mikoko Pamoja Community Organisation emerges from this background of collaboration and trust and involves some of the same individuals. The initial establishment of Mikoko Pamoja has involved community consultations and barazas (open village meetings) in Gazi and Makongeni, participatory appraisal exercises involving local people in ranking priorities and considering risks and high-profile recruitment exercises for the community organisation representatives.

Continued community, consultation, participation and involvement is central to the vision of Mikoko Pamoja and the project cannot succeed without it. The MPCO is a core part of this involvement and will also facilitate wider engagement. The annual Community Benefit

Consultation Process described in section 3 will involve all local people in the chance to influence priorities for spending. Elections will be held to the MPCO and meetings of this group will be open to local people, with minutes publicly available on village noticeboards and on the website.

One third of all funds generated from the project are anticipated to go directly to the community development account, for spending on local priorities as decided by local people. More than one third of income will be spent supporting project activities that will employ local people and hence bring direct livelihood benefits. Income from the woodlot will be available after four years and this will also contribute to the development account.

The main structures in place to ensure community ownership and engagement are summarised in figure 3:

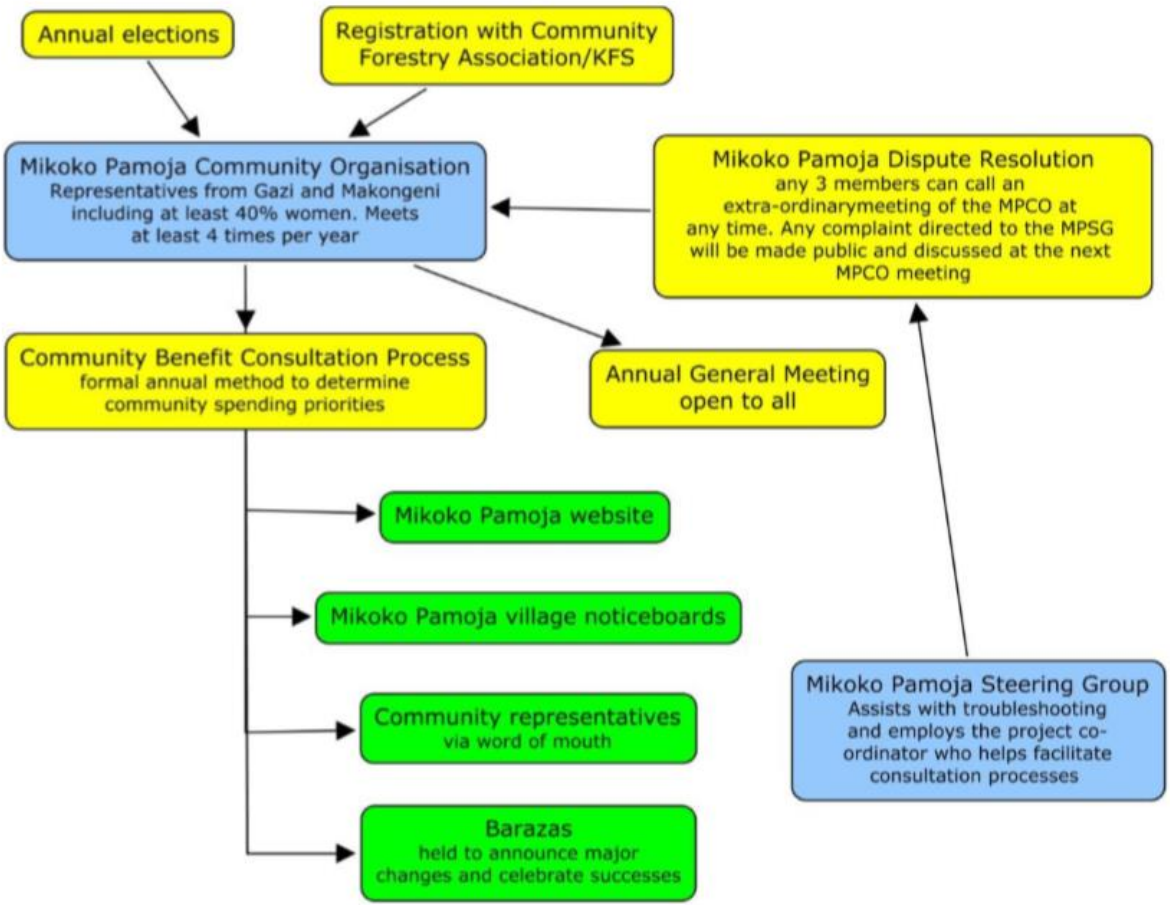

Figure 3. Summary of main methods of community involvement and consultation. Boxes in blue are organisations, in yellow are processes and in green are platforms for communication.

In the event of any dispute that may arise between the parties in relation to this contract, all parties will meet to discuss how to resolve the dispute. If one party remains unsatisfied or if the parties fail to reach an agreement, they will refer their dispute to the Appeal and Complaints Committee. The Committee will be constituted of the following people:

i. One representative from ACES
ii. One representative from MPCO.
iii. One elected representative from each of the villages participating in Mikoko Pamoja.
iv. Two persons of appropriate qualifications and expertise chosen by both parties to represent them.

Part F: Ecosystem Services & Other Project Benefits

F1. Carbon benefits

Table 3. Carbon benefits

	1	2	3	4	2-(1+3+4)
Intervention type (technical specification)	**Baseline carbon uptake / emissions i.e. without project (t CO_2e/ha)**	**Carbon uptake/emissions reductions with project (t CO_2e/ha)**	**Expected losses from leakage (t CO_2e/ha)**	**Deduction of risk buffer (t CO_2e/ha)**	**Net carbon benefit (t CO_2e/ha)**
Avoided deforestation and forest restoration (activity area 1)	Loss of 42.5 tCO2e / ha (including above and below-ground emissions)	Uptake of 380 tCO2 / ha (including above and below-ground accumulation)	0	63.4	359.13
Reforestation and forest protection (activity area 2)	Loss of 10.19 tCO2e / ha (including above and below-ground emissions)	Uptake of 380 tCO2 / ha (including above and below-ground accumulation)	0	58.5	331.7
Reforestation of eroded beach area (activity area 3)	0 (bare deforested area)	117.5	0	17.6	99.88

F2. Livelihoods benefits

MPCO generates direct and indirect benefits to participating communities. The finance generated by the sale of carbon credits is be used to support community development projects in education, health, water and sanitation, and environmental conservation. The project will generate benefits beyond carbon, including; increased fishery and other biodiversity, shoreline protection, as well as propelling livelihood projects in beekeeping, mangrove ecotourism and other nature-based livelihoods (Table 4).

This project responds directly to Sustainable Development Goals (SDG), particularly; SDG13 (climate action) and SDG 14 (life below water); as well as indirectly to SDG 1 (no poverty), SDG 2 (zero hunger), SDG 4 (quality education), SDG 6 (clean water and sanitation), SDG 8 (decent work and economic growth) and Aichi Biodiversity Target 15 on ecosystem resilience and biodiversity.

Table 4: Livelihood benefits

Food and agricultural production	**Financial assets and incomes**	**Environ-mental services (water, soil, etc.)**	**Energy**	**Timber & non-timber forest products (incl. forest food)**	**Land & tenure security**	**Use-rights to natural resources**	**Social and cultural assets**
Positive impacts on livelihoods and food security e. g aquaculture, bee-keeping, ecotourism, animal production, vegetable production	Enhanced income via sale of carbon credits. Funds to create directly and indirectly over 50 jobs and promote community enterprises.	Project will minimize severe soil erosion and stabilized sediments in Gazi Bay.	Alternative woodlots and use of clean energy stoves will meet community energy demands.	Enhanced timber and non-timber products through avoided deforestation, reforestation and alternative woodlots.	Tenure rights and security for all community Members via management agreement between MPCO & KFS.	Community access to natural resources will be enhanced.	Improve community wellbeing (electricity, Education & health) and enhancing cultural ecosystem services (aesthetic & spiritual).

The main potential negative impacts of the project on livelihoods and welfare involved the restrictions on collecting fuelwood and timber from the protected areas. There were two people occasionally employed as woodcutters at Gazi. Since project initiation their activities of cutting have been restricted but they have enjoyed enhanced income as project scouts and we have met demands for wood and timber products from woodlots.

F3. Ecosystem & biodiversity benefits

The project area harbours highly significant marine and coastal biodiversity and has a rapidly growing human population dependent on marine and coastal resources for their livelihoods. Overfishing, destructive fishing practices, illegal logging and unsustainable resource use patterns are major threats facing natural resources in the project area. Improved mangrove forest management activities will enhance ecosystem integrity and thereby enhance productivity and biodiversity in the area (Table 5). Mangroves restored through the project would, also, protect shoreline from erosion and control sedimentation of the nearshore marine ecosystem.

Table 5. Ecosystem Impacts

Intervention type (technical specification)	**Biodiversity impacts**	**Water/watershed impacts**	**Soil productivity/ conservation impacts**	**Other impacts**
Avoided deforestation and forest restoration *Rhizophora mucronata* forest protection (activity area 1)	Improve mangrove habitat quality for fish and other organisms and preserve the integrity of connected ecosystems such as seagrass and coral	No expected impacts	The protection will enhance sediment accretion and coastal stability	Reduced carbon loss and all other services enhanced
Reforestation and forest protection *Rhizophora mucronata* plantation protection (activity area 2)	Reforestation with suitable species enhances mangrove biodiversity and ecosystem functions. The replanted forest will support fisheries, biodiversity and other ecosystem services.	No expected impacts	The protection will enhance sediment accretion and coastal stability	Reduced carbon loss and all other services enhanced
Reforestation of eroded beach area *Sonneratia alba* plantations (activity area 3)	Reforestation with suitable species enhances mangrove biodiversity and ecosystem functions. The replanted forest will support fisheries, biodiversity and	No expected impacts	The protection will enhance sediment accretion and coastal stability. This is particularly pertinent to this eroded beach area,	Reduced carbon loss and all other services enhanced

	other ecosystem services.		where mangrove restoration has had negative impacts on erosion inland.	

Part G: Technical Specifications

G1. Project intervention and activities

The planting target was revised in 2020 to reflect challenges faced by the project team in planting arising from environmental conditions (primarily sedimentation and wave impacts). In the case of the project area, avoided deforestation and forest protection deliver higher carbon and other benefits than forest restoration, proportionate to resources required. The decision was therefore taken to concentrate efforts on avoided deforestation and forest protection in order to maximise benefits delivered by the project.

Table 6. Project interventions and activities summary

Activity Areas	**Type of activity**	**Objectives**	**Brief description**	**Target areas / groups**
Rhizophora mucronata forest protection (activity area 1)	Avoided deforestation and forest restoration	Carbon sequestration, restoration of forest ecosystem services	107 ha of natural, native Rhizophora forest which has been degraded by years of legal and illegal cutting. We will protect this forest area and allow natural regrowth. Under-planting in some areas will be pursued where natural regeneration is not adequate	People of Gazi and Makongeni villages (the Mikoko Pamoja Community Organisation area)
Rhizophora mucronata plantation protection (activity area 2)	Reforestation and forest protection	Carbon sequestration and restoration of forest ecosystem services	10 ha of native Rhizophora plantation, divided into a 7 and 3 ha plot, established 18 and 11 years	People of Gazi and Makongeni villages (the Mikoko Pamoja Community Organisation area)

			ago respectively. These are growing well but currently have no formal protection and are vulnerable to illegal incursion.	
Sonneratia alba plantations (activity area 3)	Reforestation of eroded beach area	Beach and shoreline protection, restoration of fisheries habitat, carbon sequestration	An area of 0.2 ha yr-1 will be planted with this native species in order to restore forest damaged 40 years ago. High wave impacts and eroding sediments mean a challenging environment for tree survival hence trees will be grown in nurseries and planted in protected, dense stands	People of Gazi and Makongeni villages (the Mikoko Pamoja Community Organisation area)

G2. Additionality and Environmental Integrity

The carbon benefits proposed are all additional to current practice at Gazi. Table 7 summarises the additionality tests of regulatory surplus, common practice, and barriers to implementation.

Together with the national constitution (2015) several sectoral laws and policies govern coastal and marine ecosystems in Kenya. Forest Conservation and Management Act (2016) provides the legal framework for the management of forest resources in the country. The Act provides for the establishment, development, sustainable management, utilization as well as conservation of forest resources using approved management plans and participation of stakeholders. This blue carbon project will empower communities in Gazi bay to successfully implement the approved participatory forest management plan (PFMP) of the area.

Fisheries Act (2012) of the Laws of Kenya has provisions for protection of fish breeding

areas, including mangroves. The National Oceans and Fisheries policy (2008) aims at promoting conservation and management of oceans and fisheries resources, enhancing food supply and food security, and developing aquaculture. Activities proposed in the current project would rehabilitate degraded mangrove areas at the same time demarcate areas critical for fisheries and other wildlife. Subsequently, these would increase food security and enhance carbon capture and storage in the area.

Article 11(1) of Land Act (2012) of the Laws of Kenya mandates National Land Commission to take appropriate action in maintaining public land that has endangered or endemic species, and critical habitats or protected areas. This project identifies important role played by mangroves for fishery production, biodiversity conservation and shoreline protection; and the need to manage in an integrated manner.

The project is also aligned with Kenya's National Climate Change Response Strategy (NCCRS), National Climate Change Action Plan (NCCAP), and National Mangrove Management Plan (2017-2027). These documents advocate for GHG emissions reduction in the forest sector through afforestation, reforestation, avoided deforestation, and sustainable land management activities that would be supported by the current project.

Despite various statutes specific to environment, successful implementation of the project activities is likely to face social, financial and technical barriers. However, the project has proposed appropriate mitigation actions exceeding the current mangrove conservation and management in Kenya.

The National REDD+ strategy of Kenya is aimed at controlling deforestation and forest degradation, enhancing carbon stocks, and promoting sustainable forest management and conservation. Mikoko Pamoja seeks to generate benefits in the areas of climate, community and biodiversity; as such the project is aligned with National REDD+ activities.

In 2015, Kenya jointed other parties to UNFCCC in assenting to Paris Agreement on Climate Change. Kenya's Nationally Determined Contributions (NDCs) aims to make a 30% reduction in emissions by 2030, relative to a business-as-usual scenario of emitting 143 MtCO2e annually. Deforestation and forest degradation are responsible for more GHG emissions than most other sectors in Kenya (GoK, 2012). Like other tropical countries, Kenya has not incorporated blue carbon ecosystems in its NDC. Activities proposed by Mikoko Pamoja seeks to scale up and accelerate conservation of blue carbon ecosystems for the benefits of climate change mitigation, community livelihoods, and biodiversity conservation. Mikoko Pamoja aims at generating information that would be used to influence and ensure that mangroves are part of Kenya's NDCs.

There is a hypothetical danger in forest conservation projects that people will intentionally clear areas prior to proposing them for PES benefits. No such clearance has occurred here. The national and international parties involved (KMFRI, KFS, ACES and Edinburgh Napier) are government institutions, charities and conservation bodies; they would risk disgrace and litigation (for small rewards) if they engaged in such activity. The local people have shown a history of self-organised forest protection and reforestation. They are dependent on fish (and thus aware of the value of the forests) and have neither the means nor the information to engage in such fraud.

Table 7. Additionality Test

Test	Initial State	Action

Regulatory surplus	Project activities are not mandated by legislation or supported by commercial interests. Although there has been extensive research at the site on mangrove ecology and restoration this has not yet translated into large scale community conservation.	Reduce pressure on *Rhizophora mucronata* mangroves through avoided deforestation and forest restoration. Protect existing *Rhizophora mucronata* plantation through reforestation and forest protection. Reforest eroded beach area with *Sonneratia alba* plantations.
Common practice	Illegal timber harvesting in mangroves	Recovery of mangrove systems through community policing of illegal mangrove harvesting and replacement of timber through woodlot.
	Licensed but unsustainable harvesting of mangroves	Complete protection of project areas from licensed harvesting through negotiation of reductions in license
	Extraction of mangrove wood for fuel; this is mostly dead wood but can have negative impacts	Provision of woodlot to help provide new source of fuelwood
	Erosion and degradation of beach area	New plantations will help stabilise the beach
Implementation barriers		
Financial	No money to develop project. No system currently in place for financing ecosystem service payments	The project has secured startup funding and support from Aviva Ltd.
Technical	Communities without awareness and skills to initiate project activities and management processes	Technical support will be provided by KMFRI, Earthwatch Institute, Edinburgh Napier, Bangor, and Edinburgh Universities. This financial and technical backing will allow the project to establish without the need for loans or expensive additional technical advice.

Institutional	The mangroves in Kenya are owned by the government. However, under the provisions of the Forest Act 2005 Community Forest Associations (CFAs) are entitled to develop management plans for local forests and to benefit from the goods and services they supply. The CFA in the Gazi area exists on paper but is yet to manage a forest.	This project will use this existing legal structure and facilitate collective management of the mangrove area. It will allow the development of a social structure that extends beyond single villages and facilitates benefit sharing among all the affected communities.

Double counting

Mikoko Pamoja is the only carbon offset facility in the area as such there is no risk of double accounting expected. While most of the drivers of change are human mediated, there has been no deliberate degradation of the forest in order to meet the applicability conditions.

G3. Project Period

The crediting period is 20 years (2012-2032). The project period will be an initial 20 years with the option of extension.

The justification for this period is informed by mangrove restoration records that show mangroves taking approximately 20 years to mature. For avoided deforestation, the proposed period is considered to be adequate for meaningful ecological impacts to be achieved in terms of mangrove biodiversity and ecosystem restoration.

Annual monitoring will be conducted to assess the level of degradation while carbon sequestration rates will be assessed every three years. The proposed period will also give adequate time to review, monitor and evaluate whether the project's overall economic impact to the community has been achieved. We hope and anticipate that the project will extend beyond 20 years; achieving such an extension could form part of the five yearly review cycle. However formally committing to that in the early project stages implies further extrapolation of risk estimates and other uncertainties that we think is unjustified. Hence we are choosing 20 years for scientific and technical reasons, rather than in anticipation that the project stops or reverses after that.

G4. Baseline scenario

The mangrove forests of Gazi bay have been exploited for many years especially for building poles and fuel-wood (Kairo et al., 2001). This exploitation
continued until recently and has produced a human-impacted forest with numerous stumps and other indications of cutting (Huxham et al., 2015).

The Kenyan government owns the mangrove forests and legal extraction is limited to individuals and groups with a Kenya Forest Service licence (although illegal extraction is common). The Mikoko Pamoja project will ensure local tenure-ship through a Community Forest Association agreement and all profit from the project will be used for community benefit.

Activity area 1 is located in this natural, degraded forest (figure 2). In the past, clear felling due to the industrial extraction of fuel wood left large contiguous blank areas, including one along a wave exposed beach. This site was previously covered by a fringing *Sonneratia* forest ~ 40-70 m deep and ~800 m long. As a consequence of tree removal the site experiences coastal erosion resulting in coconut palms in the adjacent agricultural field being washed into the sea and mangrove death up-current caused by swamping of trees by eroded sand (Dahdouh-Guebas et al., 2004). These deforested areas show little or no natural regeneration but experimental restoration efforts have been successful there (Kirui et al., 2008).

Activity area 2 consists of two plantations of *Rhizophora mucronata* established in formerly denuded areas 11 and 16 years ago.

Activity area 3 is located in the deforested beach area to the south of the village (figure 1).

Carbon Pools

Table 8. Carbon pools considered in Mikoko Pamoja

Carbon pool	Included	Explanation
Aboveground biomass (living and dead trees)	Yes	The pool most open to rapid expansion and most easily monitored
Belowground biomass (living and dead roots down to 60cm belowground)	Yes	Mangroves often allocate ~50% of their biomass below ground and roots can contribute to long term C stores. We have field measurements of living and dead roots down to 60cm depth.
Dead wood	No	Not a major component of natural mangrove forests
Litter	No	The carbon pools selected for the quantification of carbon stocks are aboveground biomass (live and dead trees) and belowground biomass (live and dead roots down to 60cm belowground). Litter is removed by crabs or tides
Soil	No	The largest C sink in these forests are deep peat deposits, which may constitute up to 90% of the C present. However we do not consider the carbon stock in this pool due to scientific uncertainty over rates of accretion and loss.

Our *plan vivo* involves three different activity areas with different initial carbon stocks (Table 9):

1. *Rhizophora* forest. This is part of the main forest at Gazi with an estimated aboveground dry mass (mean ± SE) of 452 ± 72 t ha-1 (Kirui, 2006). Belowground dry mass (to 60cm depth) is 35.8 t ha-1 living roots and 32.6 t ha-1 dead roots (Tamooh et al., 2008). But note that this 68.4 t in total is a large underestimate of below-ground carbon since most of it will lie below this depth. The project will protect two areas within this forest type; a 100 ha area in the main natural forest and an area of 7 ha located nearer to the village and close to a mangrove walkway and developing eco-tourism centre (Figure 1).

2. *Rhizophora* plantations. These are small (7 ha and 3 ha) areas of Rhizophora trees planted 16 and 11 years ago respectively (Figure 1). At 12 years of age the larger plantation had 141.56 t ha-1 total dry mass, consisting of 106.7 ± 24 (mean ± SD) aboveground mass (Kairo et al., 2008) as well as 35.9 t ha-1 belowground dry mass comprised of 24.9 t ha-1 living and 10 t ha-1 dead roots (Tamooh et al., 2008).

3. Open beach. This is an area of beach that was clear-felled some 40 years ago and is now suffering from erosion (Figure 2). The baseline carbon here is therefore zero.

Table 9. Initial carbon stocks in project activity areas

Activity area	**t dry mass/ ha (aboveground and belowground)**	**t C/ha (aboveground and belowground)***	**Area (ha)**	**t C (area x C/ha)**
Rhizophora forest	520.40	244.6	107	26172
Rhizophora plantations	141	66.3	10	663
Open beach	0	0	8	0

The methods used to estimate these stocks are described in the peer-reviewed literature cited above. A summary of these is provided below:

Aboveground biomass: Kirui et al. (2006) randomly sampled 32 10*10 m plots within the main forest area (area 1) to measure structural characteristics. They developed site-specific allometric equations for *Rhizophora mucronata* that relate DBH (diameter at breast height) to total aboveground dry mass (as established by drying Mikoko Pamoja Technical Specification Carbon Pools 10 and weighing sample trees) and used these data to derive their estimate of aboveground biomass. We use their work to provide our initial C estimate since it is the most recent, comprehensive and peer reviewed data available giving sitespecific numbers, and we do not expect carbon stocks to have changed significantly since the time of the survey. Aboveground C stocks in the older and larger plantation were estimated by Kairo et al. (2008). Again these estimates are the most thorough available and are not expected to differ significantly from contemporary carbon stocks. We have no independent estimates for the smaller, younger plantation, but since it is in a similar location and now of the same age as the larger plantation when it was surveyed we think using the

same figures is justified (particularly given its small size and small contribution to total C credits).

Belowground biomass: the methodology is described in full in Tamooh et al. (2008) and this text is taken from there:

> Three 10 x 10 m plots were marked in the Rhizophora forest and two in the plantation. Four trees per plot were randomly selected for root coring. A ring was drawn around the base of each tree and was subsequently subdivided into 3 parts at 120o . For each tree, three cores (60 cm deep and 15.6 cm diameter) were taken from each of three horizontal positions; at the tree base, at mid canopy and at the edge of the canopy. Hence, a total of 36 cores were taken per plot. Cores were divided into three 20 cm vertical categories: 0-20 cm, 20-40 cm, and 40-60 cm. Each sample was washed over a 1 mm mesh and live and dead roots separated. Live roots were then sorted into diameter classes: < 5mm, 5-10mm, 10-20 mm, 20-30 mm, 30-40 mm and >40 mm. All roots were weighed fresh. A representative fresh sub-sample from each root class was oven dried at 800 C to a constant weight and re-weighed. Results obtained were pooled to obtain dry root biomass per unit ground area.
>
> The calculations were based on the dry weights obtained. For root biomass at the base of tree stems, the basal area of the trees (G, per m_2) within the 100 m_2 plot was determined using the conventional basal area formula (Cintrón and Schaeffer-Novelli, 1984);

$$G = \frac{\sum [(D/2)^2 \pi]}{10000}$$

> Where D (cm) was diameter at breast height (1.3 m above ground) of the trees in the plot. Basal area was summed over all trees within each plot. The area occupied by a single core (Acore) was 0.0191 m2 (15.6 cm diameter). Root biomass at the middle (Mmiddle) and edge (Medge) of the tree canopy for all species were found not to differ significantly and were therefore pooled together and considered as root biomass “between” the trees in the calculations, i.e.:

$$M_{\text{between}} = \frac{M_{\text{middle}} + M_{\text{edge}}}{2}$$

> Therefore,

$$M_{\text{TOT}}^{\text{plot}} = M_{\text{base}} \frac{G}{A_{\text{core}}} + M_{\text{between}} \frac{(100 - G)}{A_{core}}$$

where plot M_{TOT} and M_{base} were the total mass of roots for the 100m_2 plot and the mass of

roots at the base of trees, respectively. Values per hectare were then correspondingly obtained.

Baseline Emissions

In the absence of the project the forest area will suffer a reduction in above and below-ground carbon stocks because of unlicensed removal:

Unlicensed cutting – aboveground C
Abundant evidence (including numerous peer-reviewed studies) demonstrates that the forests have suffered significant human impacts over the last few decades. Kairo (1995) documented extensive signs of cutting and recorded the results of early attempts to restore forests. Kairo et al. (2001) described how the mangroves at Gazi fit a general pattern of over-exploitation in Kenya. Using aerial photographs Dahdouh-Guebas et al. (2004) showed a loss of 51% in mangrove coverage between 1972 and 1992 in one area of the bay and predicted further losses based on these past trends and on vegetation analyses. Recent unpublished work by the team shows how the mangroves in Gazi Bay are economically over-harvested, representing a secondary forest with extensive human impact in comparison to more pristine northern forests (Cohen et al., 2013). Aboveground biomass in area 1 (the main forest) was estimated as 515 t ha in 1992 (Slim et al., 1996); comparison with the more recent estimate by Kirui et al. (2006) implies a loss of aboveground biomass of 4.5 t ha-1 yr-1 within the main forest (area 1). In addition, ecophysiological modelling shows that the forests in the area could show similar levels of productivity to those in the north if spared from human impact (Blumowski, 2011).

The project team have completed an analysis of mangrove spatial coverage in Kenya using satellite imagery and aerial photography and tracking changes between 1985 and 2010 (Kirui et al., 2013). This showed an average rate of loss of 0.7% yr-1 across the whole of Kenya for those 25 years and 0.28% yr-1 in the decade before 2010. We will use this national estimate of 0.28% loss per year as our expected change in spatial coverage in the absence of project activities and translate this spatial loss to loss of carbon. Where the forest coverage is projected to remain (i.e. the large majority of our proposed protected areas) **we assume a baseline of no carbon loss due to degradation**. This is conservative for two reasons:

1) Most of the impact that is easily seen on the ground and is recorded in the literature is forest degradation rather than total removal. The 0.28% yr^{-1} estimate does not address forest degradation (since the remote sensing techniques cannot detect it). Protecting degraded forests from further degradation will result in them accumulating biomass, but in the absence of data from pristine un-cut forests (or detailed time-series showing historical loss due to degradation) it is not possible to accurately say how continued degradation would reduce biomass. The best estimate available is that the Gazi forests have lost 4.5 t ha^{-1} yr^{-1} due to forest degradation over the 14 years between 1992 and 2006. Since we have only this single previous published estimate, and given the variability involved in these figures, we have chosen to assume a highly conservative zero change baseline for forest degradation.

2) Historical rates of forest removal in the Gazi area have far exceeded the 0.28% value (Dahdouh-Guebas et al., 2004) and we will use only the most recent and slower rate from the national assessment rather than the faster average rate taken over 25 years. Recent work by the project team (Rideout et al., 2013) using remote sensing data to identify risk factors showed hotels, roads and related coastal developments

to be important drivers of loss; these are particularly concentrated in the populous south coast and rates of loss here exceed those in the north.

Unlicensed cutting – belowground C

Most carbon (up to 98%) in mangrove forests is held belowground in carbon rich sediment/peat (Donato et al., 2011). Disturbing or destroying the mangrove ecosystem is likely to release this carbon, although the processes involved are not well researched. Current work at Gazi by the project team is quantifying fluxes of GHG released after experimentally killing mangrove trees. Figures 4 and 5 show the fluxes of CO2 and CH4 recorded in *Rhizophora* plots after girdling trees (Lang'at et al., 2014):

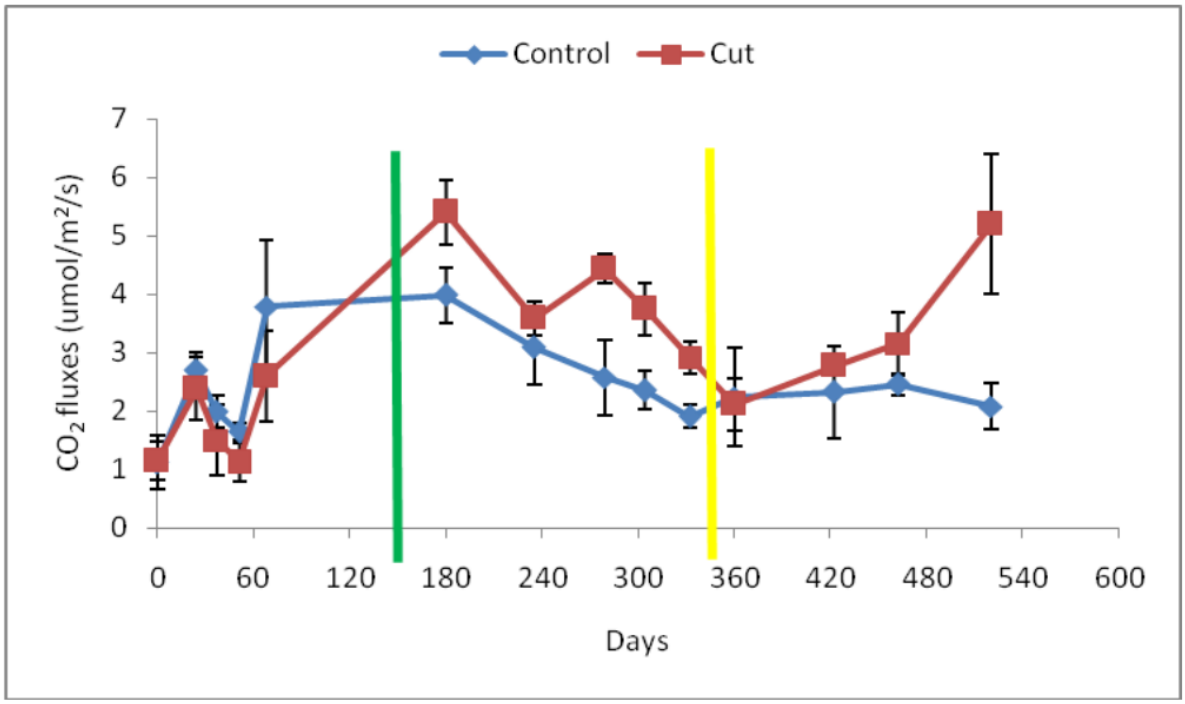

Figure 4. Mean (± S.E.) CO2 fluxes in *Rhizophora mucronata* forest.

Girdled period was between 150 (green vertical line) and 340 (yellow vertical line) days after start of sampling, clear-cut period = 340 days onwards.

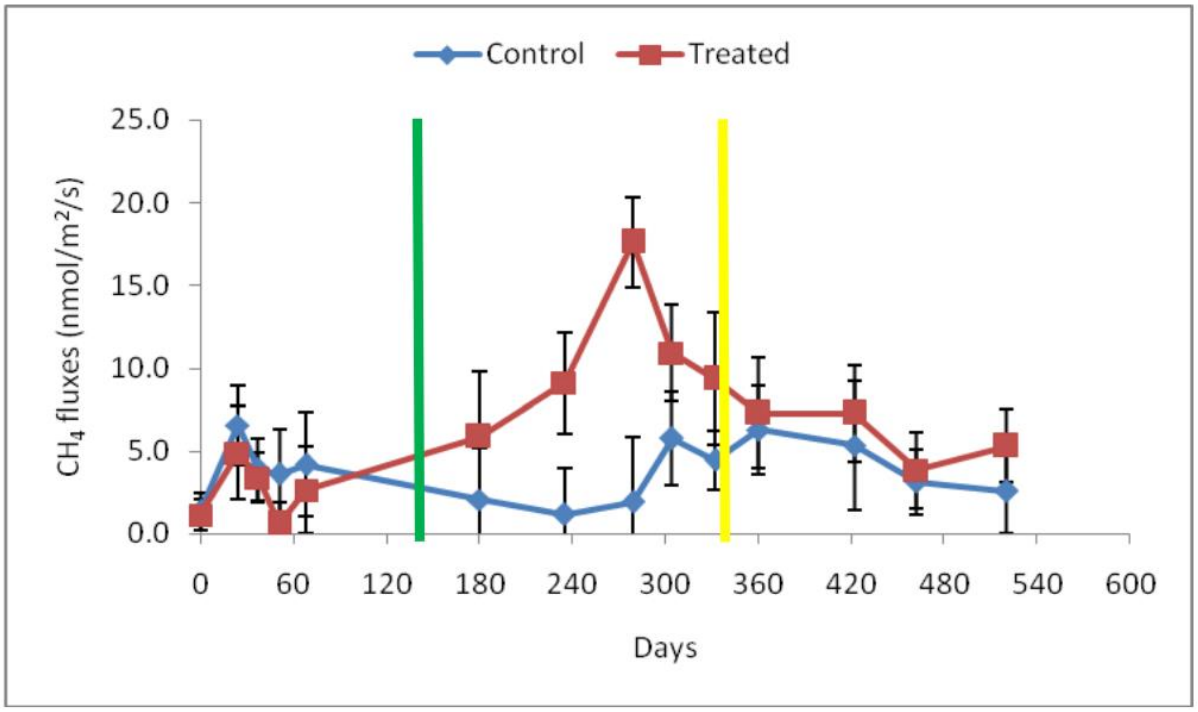

Figure 5. Mean (± S.E.) CH4 fluxes in *R. mucronata* forest.

Girdled period was between 150 (green vertical line) and 340 (yellow vertical line) days after start of sampling, clear-cut period = 340 days onwards These results show enhanced carbon dioxide and methane fluxes (above the control values) as a result of cutting, equating to roughly equivalent to an extra 1.3 micromoles m-2 s -1 (or 3.85 t C ha-1 over 290 days) CO2 and 7 nmol m^{-2} s^{-1} (or 0.021 t C ha^{-1} over 290 days) CH_4 . These results are presented over 290 days since this was the period of time between experimental girdling of trees and their complete removal. Whilst methane emissions had returned to control levels after this time, CO2 fluxes remained elevated. In fact, plots in which trees had been killed now show highly significant on-going subsidence as a result of the decomposition of belowground material (Figure 6).

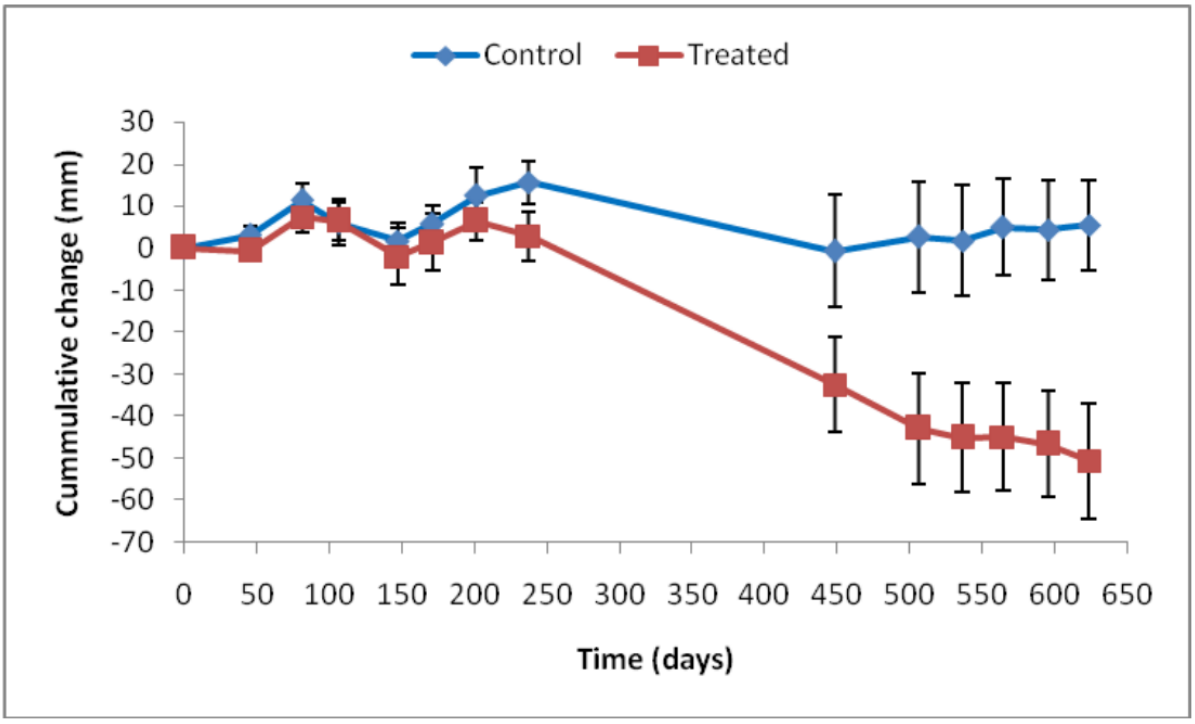

Figure 6. Mean (± S.E.) cumulative elevation change in *R. mucronata* forest.

In order to make a conservative estimate of below-ground carbon losses resulting from mangrove cutting we assume **1t C** will be lost for each hectare of trees lost in area 1. This is highly conservative since it represents only around 25% of the total C flux recorded in our experimental clear-cut plots and also assumes that fluxes return to normal one year after cutting (i.e. that there is no on-going additional C loss). We assume an equivalent proportion (i.e. 0.32 t C per ha) will be lost from the plantation areas.

Table 10. Summary of current and projected C stocks in three activity areas. The time period for the projection is 20 years. We assume an annual 0.28% loss in area and a loss of 1 tC/ha in substrate fluxes in the first year after clearing.

Carbon Stocks	**Rhizophora forest**	**Rhizophora plantations**	**Open beach**
INITIAL STOCKS			
Area (ha)	107	10	8
Initial tC/ha (aboveground)	212	50. 2	0
Initial tC/ha (belowground)	32.1	16.9	0
Initial tC (area x C/ha)	26124	671.2	0
PROJECTED STOCKS			
Area (ha)	101.2	9.45	8
Projected tC (aboveground)	21454	474.4	0
Projected tC	3429	169	0

(belowground)*			
Projected tC (total)	24883	643.4	0
TOTAL C LOSS	1241	27.8	0

G5. Ecosystem service benefits

A summary of credited carbon benefits produced by the project is given in Table 11 below – this is taken from the Technical Specification for Mikoko Pamoja (Table 10) which is available at https://planvivo.org/docs/Mikoko-Pamoja-mangroves-TS-FINAL.pdf . This document contains full details on the methodologies used to derive these figures.

Table 11. Annual carbon benefits and annual income anticipated (assuming a price of $7 t CO2)

Activity	Activity area	Carbon pool	Area (ha)	C benefit (t CO_2 ha^{-1} yr^{-1})	Total annual C benefit (t CO_2 yr^{-1})	Income ($)
Rhizophora mucronata forest protection	activity area 1	aboveground carbon	107	16.5	1766	12,359
Rhizophora mucronata forest protection	Activity area 1	belowground carbon	107	2.5	265	1,854
Rhizophora mucronata plantation protection	Activity area 2	aboveground carbon	10	16.5	165	1,155
Rhizophora mucronata plantation protection	Activity area 2	belowground carbon	10	2.5	24.8	173
Sonneratia alba plantation	Activity area 3	above and belowground carbon	0.2	a	24	168
Avoided deforestation	Activity areas 1+2	from Table 3	6.3	b	241	1,687
TOTAL					2485	18431
TOTAL after deduction of risk buffer*					**2112**	**15667**

* with risk buffer of 15% [a] see calculations in appendix 2 [b] see calculations in appendix 3

G6. Leakage & Uncertainty

Leakage risks come from two sources: licensed and un-licensed cutting. The proposed responses to these, which should prevent leakage, are summarised in Table 12.

Table 12: Potential leakage problems and mitigation actions to be adopted.

Activity Type	Potential Leakage	Mitigation Measure(s)
Protection of areas 1 and 2	Activity leads to increased harvesting in other areas to meet demand for timber and fuel-wood.	Establishment of community Casuarina woodlot to provide local source of fuelwood and building poles along with a long term source of community income. Fuelwood will become available from the woodlot in the first year and building materials will be available from the Rhizophora plantations when thinned in year 1.

Part H: Risk Management

H1. Identification of risk areas

Four risk categorises were identified in the project (Table 13). Mitigation measures have been identified and are expected to lower the risk level.

Table 13. Identified risks

Risk Factor	Mitigation Strategy
Legal/Social	
Disputes caused by conflict of project aims/activities with local communities/organisations	Participatory planning and continued stakeholder consultation over project lifespan. Involvement with all relevant local communities. All project funds spent after full consultation with and agreement of community bodies.
Disputes between different local stakeholders and different communities surrounding the project area over fair distribution of profits	All spending priorities will be agreed through a comprehensive community consultation process involving and require the final authority of a Mikoko Pamoja community council which will include wide representation from local people.

Changes in licensing arrangements or issuing of new licenses for cutting in the conserved area	Close working relationship established with Kenya Forest Service, the licensing authority. Use of the project as a flagship demonstration site for national policy.
Project Organisation	
Management of activities not carried out effectively	Project managers and staff adequately trained. Project overseen by experienced researchers and managers with a long term personal stake in success (including a key partner based permanently at the site).
Turn-over of key staff leading to skills gaps	Key staff (such as project administrator) will work as part of a larger team with others deputizing and hence learning the role
Economic	
Financial failure caused by poor or fluctuating carbon price or by failure to attract buyers	Initial costs already underwritten by backers. Organisations such as Aviva Ltd lined up as interested buyers. Initial small scale of the project limits our risk and gives the potential for future expansion. Casuarina woodlot will provide secure income to help during any poor years.
Natural	
Pests and diseases	Sonneratia can be susceptible to infestation although this rarely causes death of trees. Beach site trees will not all be planted contiguously, rather planting sites will be spread along 2.5 km
Extreme climatic events, particularly storm events, drought and fire.	Severe storms are very rare. Beach site is exposed to wave action which will lead to mortality but this is already assumed in our growth projections. Mangroves are unaffected by fire and much less susceptible to drought than terrestrial forests.

H2. Risk buffer

A carbon risk buffer is a proportion of carbon that is kept aside and not sold as Plan Vivo Certificates. Output from the Bioclimate Risk tool (Bioclimate 2010) suggests an appropriate risk buffer of 11% (the full table is in Annex 8). The risks and mitigation strategies Mikoko Pamoja Technical Specification Carbon Benefits 25 outlined qualitatively above concur in suggesting low levels of risk. As a conservative assumption we will apply a risk buffer of 15%.

Part I: Project Coordination & Management

I1. Project Organisational Structure

Mikoko Pamoja Community Organization (MPCO) is a government-registered community organization that shall coordinate community engagement, routine project activities and benefit sharing. It is governed by volunteer office members who are village representatives from the project area. The office members have the

responsibilities of community administration and implementation of project work plans. Project technical work is coordinated by a paid Project Coordinator who plays a key role in the office of the MPCO and provides a link with the Mikoko Pamoja Steering Group.

The Mikoko Pamoja Steering Group (MPSG) provides the necessary technical expertise in biological (carbon accounting) and social (socioeconomic monitoring) areas. Steering group members are unpaid volunteers.

The Association for Coastal Ecosystem Services (ACES) is a charity registered in Scotland that can hold an independent and transparent account from which payments for carbon credits can be transferred to MPCO upon meeting annual targets. ACES is the Project Coordinator Organisation, responsible for selling Plan Vivo Certificates, overseeing the transfer of funds to the MPCO and reporting to the Plan Vivo Foundation.

The MPCO shall work closely with the KFS and the established Gogoni Gazi Community Forest Association. A detailed description of the Project organization is given in Figure 7 and in Table 14:

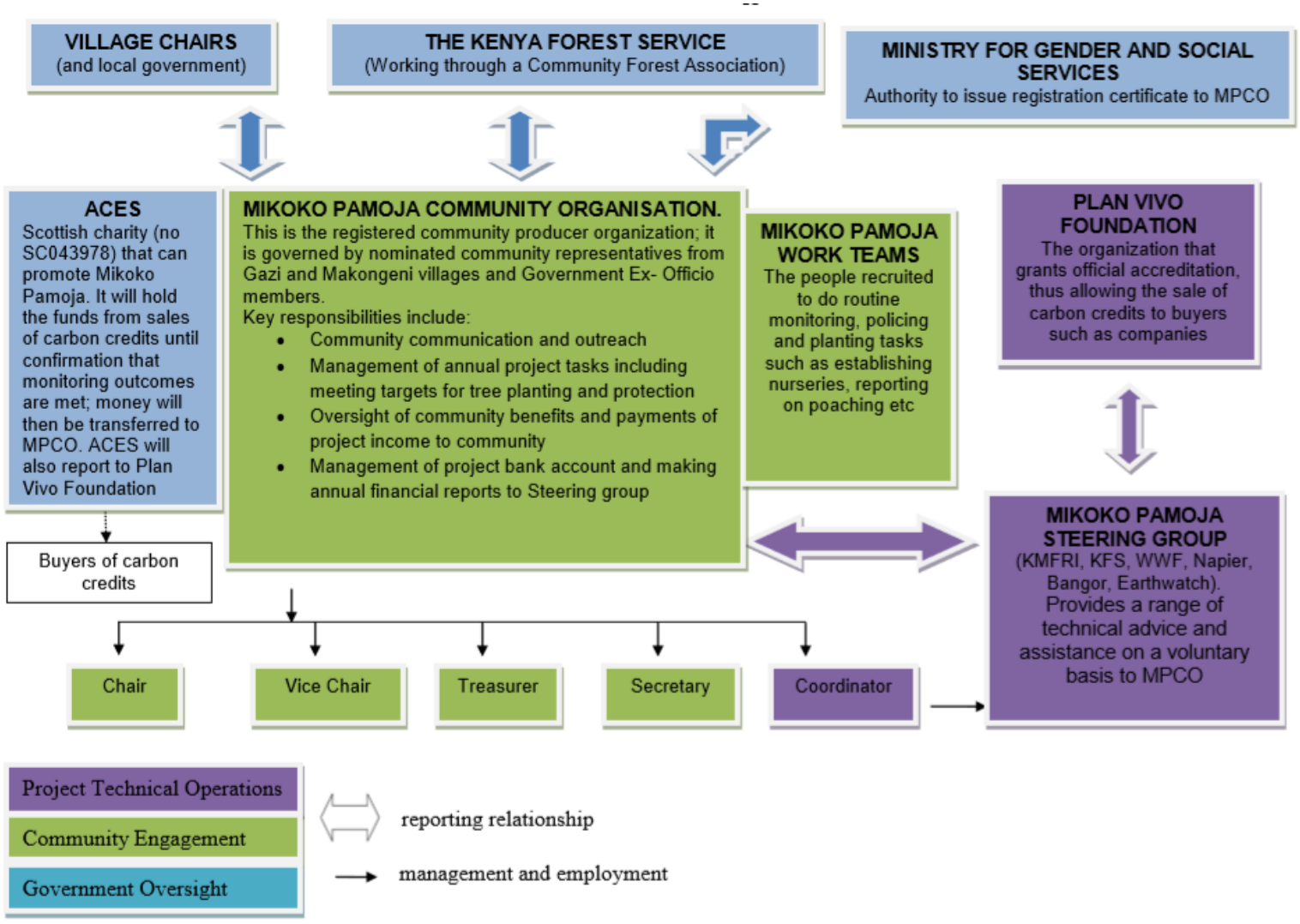

Figure 7 – Mikoko Pamoja Organisational Structure and Governance

Table 14. Project participants

Key Function	**Organisation/ group(s) involved**	**Type of group/ organisation and legal status**	**Brief description of activities**
Project Coordination	ACES	Charity registered in Scotland	• ACES mandate is to support projects like Mikoko Pamoja through educational and fundraising activities. A key specific function for Mikoko Pamoja will be to facilitate the sale of carbon credits to overseas buyers, and then provide a tax free and transparent bank account where the money can be held until achievement of monitoring targets; it will then be transferred to the MPCO. ACES accounts will be audited annually according to Scottish charity law • Work to secure and support sales of Plan Vivo Certificates • Negotiate deals with buyers of Plan Vivo Certificates • Responsible for selling carbon • Reporting back to the Plan Vivo Foundation
Project Administration	Mikoko Pamoja Steering Group (with the paid position of MP coordinator)	Consisting of project founder organisations from within and outside Kenya including KMFRI, KFS, WWF, Edinburgh Napier, Bangor, Earthwatch Institute.	• Provide help and advice to MPCO in all technical matters • Help to plan, oversee and guide the organization and implementation of all project activities • Community capacity development, institutional development, troubleshooting if required • Promote equitable benefit sharing at community level • Engage with relevant government and civil society stakeholders to ensure ongoing support and strengthening of external institutional processes • Coordinate extension of project activities & opening of new project sites • Help train the MPCO on the science and policy of carbon trading

			• Encourage linkage of Mikoko Pamoja with other groups particularly through EAFPES • Aid in dispute resolution with the stakeholders in the organization and community • Recruit and administer the post of project co-ordinator.
Project Technical Operations	The Mikoko Pamoja Community Organization		• Routine monitoring of annual commitments and reporting on these to MPSG and ACES • Policing of boundaries • Regular reporting on project progress and implementation and minuting of these reports • Implementation of work plans
Community Engagement/ Participation	The Mikoko Pamoja Community Organization		• Participatory Planning, Decision Making and implementation of Mikoko Pamoja activities • Mobilization of villagers for project meetings and activities. • Mikoko Pamoja spokespersons for the community during the project activities. • Recruiting of MP volunteers for various related community activities. • Feedback Barazas (open village meetings) organizers and speakers. • Mikoko Pamoja representatives to the Community Forest Association. • Facilitate the sharing of benefits from the project by arranging community consultations on priorities and ensuring fairness and equitability in distribution of funds

I2. Relationships to national organisations

The Mikoko Pamoja project relates to various arms of government based on the roles and responsibilities expected from the various groups within the project.

The Kenya Forest Service – A government institution with the mandate of management of all national forests.

The Mikoko Pamoja Community Organization, registered with the Ministry of Gender and Social Services. This is the ministry mandated to encourage community development and the registration of volunteer community groups. MPCO is formally registered as a legal entity through this ministry, allowing it to hold a bank account and perform other registered legal functions. Annual renewal of the license is dependent on correct auditing of minutes and accounts.

The Gazi-Gogoni Community Forest Association (CFA) – A registered community association in charge of co-management of the forest. This particular aspect of participatory forest management is embedded in the Kenya Forest Act 2005.

The Kenya Marine and Fisheries Research Institute – A government institution with the mandate of performing research in the marine and fisheries sectors. The Mikoko Pamoja project has arisen from KMFRIs long engagement with mangrove science and KMFRI will remain a key guiding organization within the Mikoko Pamoja steering group.

The Mikoko Pamoja project is intended to act as a leading example of a National Adaptation Mitigation Action (NAMAs) within the National Climate Change Response Strategy, and hence relates to national strategy.

The project is also in line with national development blueprint, Kenya Vision 2030; that has flagged up the potential of carbon investment in financing forest conservation.

I3. Legal compliance

The Kenya Forest Act (2005) is the most pertinent local legislation since it mandates collective management of Kenyan forests. We will be operating under this act by helping to establish and run a registered Community Forest Association.

Some of the key legislations that the project will contribute to will include:

- The Constitution of Kenya (2010), targeting a national forest cover of 10%.
- Forest Conservation and Management Act (2016) providing for community participation in forest management, including mangroves. Participation of the community is further highlighted in the National Mangrove Ecosystem Management Plan (2017-2027)
- Kenya National Biodiversity Strategy and Action Plan (NBSAP, 2000), objectives 1, 3, 6 and 10, calling for capacity building, conservation, sustainable use of biodiversity and implementation
- Integrated Coastal Zone Management Policy and Action Plan (2010), calling for integrated coastal resource management
- National Climate Change Response Strategy (NCCRS) (2010) calling for low-carbon pathways in the national development and National Climate Change Action plan (NCCAP) promoting mangrove restoration activities
- Environmental Management and Coordination Act (2015), providing for EIAs and SEAs to be applied for all developments
- Fisheries Management and Development Act (2016) that recognizes mangroves as critical habitat for fisheries and other wildlife; and the need for their conservation.

Overall, project will support the Kenya's implementation of Sustainable Development Goals, particularly; (SDG) 1 (poverty alleviation), 13 (climate action), 14 (life below water); as well as Kenya's commitments to Aichi target 15 and the National Biodiversity Strategy and Action Plan, objectives 1, 3, 6 and 10.

The project coordinator will adhere to the principles of fairness and gender rule in employment as stipulated in the Constitution of Kenya (2010). He will be guided by the VBF constitution as well as working closely with the executive committee in any employment process.

I4. Project management

Implementation of MPCO is vested with Project Coordinator working with democratically elected committee representing the villages of Gazi and Makongeni. In accordance with Plan Vivo guidelines, independent validation of the project will be undertaken every 5 years. The project coordinator is trained on implementation of workplan, monitoring and reporting. PC, with technical support from KFS and KMFRI, will develop a record keeping system which will document the following:

a) Minutes of the village barazas held
b) Financial income and expenditures
c) Environmental and socio-economic monitoring indicators
d) Reports from forest patrols and other project activities

The Association for Coastal Ecosystem Services (ACES) will be responsible for managing sales and transactions on the Markit environmental registry.

Table 15: Project timeline

2004 – 2010	Pilot scientific work including demonstrations of feasibility of re-planting degraded areas such as those used in activity area 3 and calculations of above and belowground carbon balance and flows
2010 - 2012	Establishment of permanent forest plots to allow monitoring of growth and carbon sequestration
2011 - 2012	Survey of baseline socio-economic situation in the project areas to inform community planning about benefit sharing and to allow monitoring of improvements
2011 - 2012	Establishment of Mikoko Pamoja Community Organisation (MPCO) and recruitment of project coordinator
June 2012	Official launch of Mikoko Pamoja at village level
July 2012	Establishment of Casuarina woodlot
February 2013	Official approval by Kenya Forest Service of management plan
May 2013	Third party validation visit
August 2013	Sale of first year's carbon credits
Oct 2013	Community benefit consultation process, led by MPCO, run to establish initial priorities for expenditure
June 2014	Annual reporting of monitoring indicators. Report from MPCO to MPSG and ACES.
July 2016	Harvesting and sale of first commercial timber from woodlot
June 2032	End of 20-year crediting period

I5. Project financial management

The anticipated financial flows for the project are given in Figure 8. 5% of funds will go to running expenses for MPSG and MPCO. Plan Vivo standard requires at least 60% of income to be allocated to communities. In our case, 26% of income is allocated for spending on community projects, as determined through the annual prioritization process. A further 36% goes to employing the local work teams and individuals – hence 62% is allocated to community benefit or community employment.

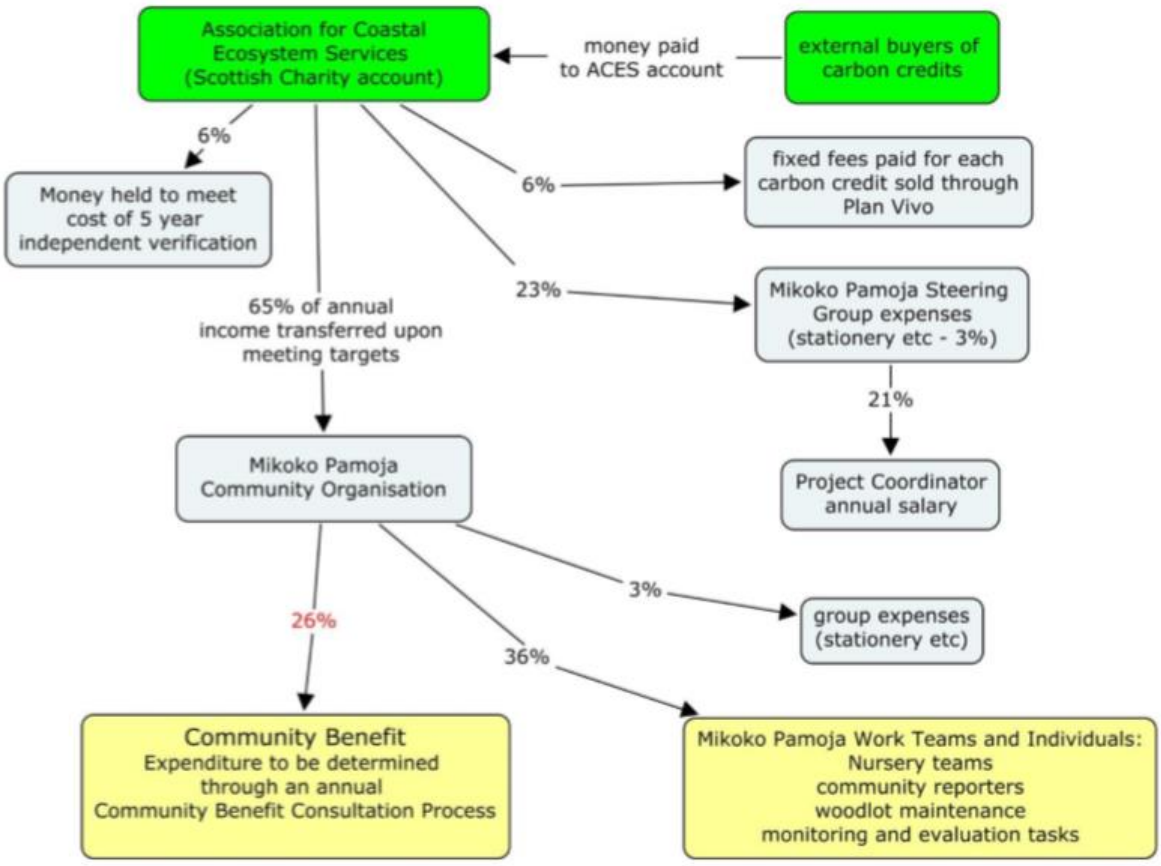

Figure 8 – Mikoko Pamoja Financial flow diagram. The figure assumes average market price for carbon at time of writing. Future income will be adjusted for inflation and may vary depending on carbon price but the proportional expenditure on different project components should remain similar over time. Boxes in yellow represent community benefit/employment, although these are conservative since the project co-ordinator will also be employed locally and so that salary could be included. The percentage in red will be the first to go up should the carbon price allow it.

Benefit sharing and financial transparency

Funds for spending on community benefit will be held by the MPCO. Expenditure from these funds will be determined during an annual community benefit consultation process. This will consist of four steps:
a) MPCO members collect ideas for expenditure from their communities.
b) A full MPCO meeting determines their preferred priorities and ranks the suggested expenditures.
c) The ranked priorities are made public, displayed in the villages and on the website, with one month for further representation from any local resident. d) A confirmation meeting of the MPCO is held to determine final priorities for expenditure. e) Annual audit is done at the end of the financial year to determine how the funds were spent.

Permitted and forbidden expenditures

The priorities for expenditure on community benefit will be determined by local people through the consultation process described above; no individual can direct expenditure on his or her own and no prior expectations are established by the MPCO. Hence the actual community benefits and projects facilitated by the Mikoko Pamoja process will be determined by local people and will remain their responsibility. Typical projects that are envisaged include improvements to the local schools and clinics, enhancement of local community initiatives such as eco-tourism and beekeeping, provision of micro-credit for small businesses, provision of hardship funds to help with short-term crises and assistance with youth groups. These ideas have emerged from community consultations already conducted and in some cases build on projects already initiated with help from the Tidal Forests of Kenya project. However, direct payments of cash as 'dividends' to individuals are not permitted (this does not preclude the payment of fees and stipends, such as school and college fees, nor the payment of salaries or cash for work conducted on behalf of MPCO).

Full accounts for Mikoko Pamoja will be publicly available, on the website and posted on village notice-boards as well as tabled at the annual MPCO confirmation meeting. All members of MPCO and MPSG have collective responsibility for ensuring good governance and financial probity. Accounts will be prepared by the MPCO treasurer with assistance from the MP coordinator. Annual accounts for ACES will be publicly available according to Scottish law.

I6. Marketing

ACES will support the project in promotional activities and advertise it to potential buyers. It will manage carbon sales and negotiations and promotion with buyers, both nationally and internationally. It will also help facilitate community engagement and decision making and ensure appropriate transfer of information to partners. ACES will manage the Markit account for carbon credits generated and use the ACES website.

I7. Technical Support

The MPCO will be responsible for recruiting and helping to train (with technical assistance) the relevant work groups including: nursery teams, monitoring teams, community reporters and woodlot maintenance and marketing workers. Hence these technical skills will become embedded in the MPCO and developed by the local people employed to assist with carrying out the relevant project functions.

Training in the technical aspects of monitoring and in project management, communication and marketing will be provided by project partners and supporters including KMFRI, Edinburgh Napier and Earthwatch Institute over the first five years of the project. We already capitalize on training provided at the site to allow local participants to benefit (for example the 2011 and 2012 capacity building teams for emerging scientists, funded by the John Ellerman Trust and providing training in field work, data analysis, scientific communication and proposal development, involved local representatives). Similarly, Saudi ARAMCO funded a short course on community-based mangrove reforestation and management. The course targeted local people trained in mangrove nursery establishment, out-planting, and maintenance.

An expansion of these training opportunities, organized through Earthwatch Institute, is planned which will allow MP project workers to train with multinational teams.

The Mikoko Pamoja Coordinating Group will retain its important role in overseeing the project and ensuring good governance but will train the project coordinator and members of the MPCO in project financial, marketing and promotional activities over the first five years. It will therefore increasingly assume a supervisory and governance role with all core project activities achieved by the MPCO and coordinator.

The presence of KMFRI staff permanently at the site means that technical support will be easily and freely available to the MPCO and work teams. In addition to this routine support many visiting scientists are available to help with any more technical or novel developments.

Links with universities in Kenya and internationally mean that many students visit the area and look for training and research opportunities. Such students will also provide a valuable source of technical support, particularly when they are conducting longer term postgraduate studies. For example the team already has PhD students who train local people in forestry and social science techniques.

Bespoke training for project related skills, such as GIS and nursery establishment, will be provided to key individuals including the project coordinator and leaders of the nursery and other work teams.

Part J: Benefit sharing

J1. PES agreements

Mikoko Pamoja project uses the existing CFA to facilitate integrated management of the mangrove forests. It will allow development of social structures that extend beyond single villages and facilitate benefit sharing among all participating communities.

J2. Payments & Benefit Sharing

All income from the sales of Plan Vivo Certificates from Mikoko Pamoja will be spent following the Community Benefit Consultation Process. Hence the details of payments to individual beneficiaries will depend in each case on the priorities determined by local people. Typically benefits will be collective, for example investment in schools and clinics (following practice already established at the site with Earthwatch and other projects). Such payments will usually be subject to standard contracting practice, with 50% advance payments, followed by 30% then 20% upon satisfactory completion; contracts will be overseen by the MPCO and the Project Coordinator.

Part K: Monitoring

K1 Ecosystem services benefits

The schedule for monitoring ecological performance indicators is given below. Monitoring will be arranged and recorded by the MPCO, initially under the direct supervision and with technical assistance from the MPSG. After the first three years supervision will be replaced by verification checks, with a team of KMFRI forestry technicians tasked to make an independent assessment of two of the indicators per year.

Monitoring results will be recorded for inclusion in the annual report and on the website and will be required before the benefit sharing process is initiated.

Data from this monitoring will be used by the project team to revise the Technical Specifications in order to more accurately reflect the additional carbon benefits being generated.

Table 16. Monitoring schedule and performance indicators

Monitoring	Areas and percentage weighting[1]	Indicator	Green threshold PES: Full payment	Amber threshold PES: 50% payment	Red threshold: No PES payment
Forest protection Frequency: Annual Outcome: no more degradation, gradual recovery of forest structure, continued growth in plantation	Area 1: *Rhizophora* Forest Weighting 84% Area 2: *Rhizophora* plantations Weighting: 14%	Stumps	No increase in proportion of basal area accounted for by stumps in 10 reference plots. No evidence of clear felling	≤ 10% increase in proportion of basal area accounted for by stumps in 10 reference plots. No evidence of clear felling	≥ 10% increase in proportion of basal area accounted for by stumps in 10 reference plots and/or evidence of clear felling
		--	AND	AND	OR
		Plot recovery and/or tree growth	Surveys of forest structure and regeneration in 10 reference plots show recovery and/or increasing above-ground biomass	Surveys of forest structure and regeneration in 10 representative plots show no change in indicators of forest health and biomass	Surveys of forest structure and regeneration in 10 plots show significant degradation in forest health and biomass
Tree planting Frequency: Annual Outcome: planting of 0.2 ha per yr on difficult exposed beach site	Area 3: *Sonneratia* tree planting Weighting: 2%	Planting	Minimum of 2000 trees planted	Minimum of 1000 trees planted	Less than 1000 trees planted
		--	AND	AND	OR
		Mortality	Mortality of 1 yr old trees < 50%	Mortality of 1 yr old trees 50-70%	Mortality of 1 yr old trees > 70%

K2. Socio-economic impacts

Monitoring of the socio-economic impacts of the Mikoko Pamoja project will be conducted annually and compared with the baseline (Table 17). Results will be provided to all key stakeholders and interested parties using diverse media including reports, briefing papers and presentations. The results will be used to discuss work plan for the coming year and the priority community projects to be supported by proceeds from sale of carbon credits. Nevertheless, this will be upon successful implementation of the previous year's work plan. The monitoring and evaluation will be based on the appropriate indicators identified below.

Data from this monitoring will be used by the project team to revise the Technical Specifications for the project. By doing so, unanticipated negative socio-economic impacts that may arise can be addressed early and new opportunities for mangrove-related local businesses and other socio-economic benefits can be identified.

Table 17. Methods of measurement of expected socio-economic impacts

Area of impact	Baseline	Target	Indicator	Method of measurement
Number and vitality of mangrove-related local businesses	Main current project is the mangrove boardwalk which welcomed 1673 visitors in 2010	Increase in the number and vitality of businesses	Number of mangrove-related local businesses and relevant income of these businesses	Annual reviews of numbers of businesses and relevant income
Impacts of individual funded projects (supported by community funds)	Zero	These will be set when the appropriate funded priority is determined by MPCO. For example micro-credit schemes will develop annual targets for lending	Specific to individual schemes. Each prioritised expenditure will require a specified and measurable output (eg construction of a school building)	Specific to individual schemes. Each prioritised expenditure will require a specified and measurable output (eg construction of a school building)

K3. Environmental and biodiversity impacts

Other than monitoring and assessing the changes in ecosystem services, other biodiversity impacts will also be monitored as summarized in Table 18. New recruitments of mangroves and abundance and diversity of fauna such as fish, molluscs and gastropods will be monitored annually. Soil accretion and erosion rates will also be determined in both the avoided deforestation and reforestation activity areas. This is crucial to determine the recovery of mangrove ecosystem functioning and to assess whether project objectives are met. KMFRI will use its research capacity to train community members on participatory monitoring and reporting of environmental and biodiversity impacts. The results of the monitoring will be reported annually following Plan Vivo Guidelines.

Data from this monitoring will be used by the project team to revise the Technical Specifications for the project. By doing so, unanticipated negative effects on biodiversity, water availability and soil erosion that may arise can be addressed early.

Table 18. Environmental and biodiversity impacts

Impacts	Baseline	Indicator	Measurements
Biodiversity impacts	Typical mangrove flora and fauna are present but degraded	Recruitment of new trees Faunal biodiversity	Regular monitoring of forest structure and growth, including recruitment of new trees. Three yearly monitoring of fauna especially crabs in protected areas
Water availability impacts	Water is abundant in the project area	Reported water availability by community members	No anticipated impacts
Soil conservation impacts	Severe erosion in activity area 3 is damaging the coastline. Slower erosion and subsidence elsewhere	Surface elevation in protected area and beach plot Sedimentation rates in protected area and beach plot	Monitoring of sedimentation rates and surface elevation in protected area and beach plots

K4. Other monitoring

Seagrass

The voluntary seagrass management area will be monitored according to the Seagrass Watch protocol, a global scientific, non-destructive, participatory seagrass assessment and monitoring program. Monitoring surveys will take place annually.

Monitoring data will be assessed by the project team to inform the inclusion of seagrass protection and monitoring in the technical specifications. ACES as project coordinators are actively engaged in exploring the potential to include seagrass in PES projects from a policy, financial and technical perspective and this initial inclusion will allow the project to explore the logistical and financial feasibility of including seagrass in a PES project. If this initial implementation of seagrass protection is feasible and successful, future iterations of the technical specifications may incorporate seagrass in a more comprehensive way.

Table 19. Monitoring of impacts of seagrass management area

Impacts	Baseline	Measurements	Objectives
Seagrass coverage	Approximately 8km$_2$ in Gazi Bay, primarily in northern (inner) bay, around mainland coast and Chale Island. The proposed conservation area will initially comprise 200 ha of intertidal	Following the Seagrass Watch protocol: annual percent cover estimations using quadrats. This will be supplemented by 5 yearly mapping of total coverage using freely available sentinel imagery.	No loss of seagrass cover

	seagrass beds in the north east of the bay		
Biodiversity in seagrass meadow	Major groups of macrofauna as recorded in Githaiga, Frouws, Kairo, & Huxham, (2019)	Survey of macrofauna (shellfish, sea cucumbers, fish etc.) – basic survey annually supplemented by detailed survey every 5 years	No significant decline in diversity or biomass
Stakeholder engagement and adherence	Initial engagement with all fishing stakeholders	Presence/absence of prohibited fishing activities within the protected area; verbal/written feedback to project team	No incursions or use of restricted fishing gears in area
Stakeholder benefits	None	Funds donated specifically to seagrass conservation activities (raised alongside sales of PVCs) and for benefits of beach management unit and other direct stakeholders	Support from key stakeholders translated into clear benefits and growing awareness

References

Bosire, J.O., Dahdouh-Guebas, F., Walton, M., Crona, B.I., Lewis, R.R., Field, C., Kairo, J.G., Koedam, N., 2008. Functionality of restored mangroves: A review. Aquat. Bot. 89, 251–259. https://doi.org/10.1016/j.aquabot.2008.03.010

Cohen, R., Kaino, J., Okello, J.A., Bosire, J.O., Kairo, J.G., Huxham, M., Mencuccini, M., 2013. Propagating uncertainty to estimates of above-ground biomass for Kenyan mangroves: A scaling procedure from tree to landscape level. For. Ecol. Manage. 310, 968–982. https://doi.org/10.1016/j.foreco.2013.09.047

Dahdouh-Guebas, F., Van Pottelbergh, I., Kairo, J., Cannicci, S., Koedam, N., 2004. Human-impacted mangroves in Gazi (Kenya): predicting future vegetation based on retrospective remote sensing, social surveys, and tree distribution. Mar. Ecol. Prog. Ser. 272, 77–92. https://doi.org/10.3354/meps272077

Donato, D.C., Kauffman, J.B., Murdiyarso, D., Kurnianto, S., Stidham, M., Kanninen, M., 2011. Mangroves among the most carbon-rich forests in the tropics. Nat. Geosci. 4, 293–297. https://doi.org/10.1038/ngeo1123

Githaiga, M.N., Frouws, A.M., Kairo, J.G., Huxham, M., 2019. Seagrass removal leads to rapid changes in Fauna and loss of carbon. Front. Ecol. Evol. 7, 1–12. https://doi.org/10.3389/fevo.2019.00062

Harcourt, W.D., Briers, R.A., Huxham, M., 2018. The thin (ning) green line ? Investigating changes in Kenya ' s seagrass coverage. Biol. Lett. 14, 28–31. https://doi.org/10.1098/rsbl.2018.0227

Huxham, M., Emerton, L., Kairo, J., Munyi, F., Abdirizak, H., Muriuki, T., Nunan, F., Briers, R. a., 2015. Applying Climate Compatible Development and economic valuation to coastal management: A case study of Kenya's mangrove forests. J. Environ. Manage. 157, 168–181. https://doi.org/10.1016/j.jenvman.2015.04.018

Kairo, J.G., 1996. Towards alternative views of mangrove forestry in kenya, in: Supporting Capacity BuiLding in Forestry Research in Africa. InternationaL Foundation for Sc;ences CIFS), pp. 305–312.

Kairo, J.G., Bosire, J., Koedam, N., 2001. Restoration and management of mangrove systems — a lesson for and from the East African region. S. African J. Bot. 67, 383–389.

Kairo, J.G., Bosire, J., Langat, J., Kirui, B., Koedam, N., Program, M.R., Sciences, B., Brussel, V.U., 2009. Allometry and biomass distribution in replanted mangrove plantations at Gazi Bay , Kenya 69, 63–69. https://doi.org/10.1002/aqc

Kairo, J.G., Lang'at, J.K.S., Dahdouh-Guebas, F., Bosire, J., Karachi, M., 2008a. Structural development and productivity of replanted mangrove plantations in Kenya. For. Ecol. Manage. 255, 2670–2677. https://doi.org/10.1016/j.foreco.2008.01.031

Kairo, J.G., Lang'at, J.K.S., Dahdouh-Guebas, F., Bosire, J., Karachi, M., 2008b. Structural development and productivity of replanted mangrove plantations in Kenya. For. Ecol. Manage. 255, 2670–2677. https://doi.org/10.1016/j.foreco.2008.01.031

Kirui, B.Y.K., 2006. Allometrlc relations for estimating aboveground biomass of naturally growing mangroves , Avicennia marina FORSK (VIERH). AND Rhizoplzora mucronata LAM . along the kenya coast Kirui , Bernard Kibet A thesis submitted to the Graduate School in partial ful. Egerton.

Kirui, B.Y.K., Huxham, M., Kairo, J., Skov, M., 2008. Influence of species richness and environmental context on early survival of replanted mangroves at Gazi bay, Kenya. Hydrobiologia 603, 171–181. https://doi.org/10.1007/s10750-007-9270-3

Kirui, K.B., Kairo, J.G., Bosire, J., Viergever, K.M., Rudra, S., Huxham, M., Briers, R. a., 2013. Mapping of mangrove forest land cover change along the Kenya coastline using Landsat imagery. Ocean Coast. Manag. 83, 19–24. https://doi.org/10.1016/j.ocecoaman.2011.12.004

Lang'at, J.K.S., Kairo, J.G., Mencuccini, M., Bouillon, S., Skov, M.W., Waldron, S., Huxham, M., 2014. Rapid losses of surface elevation following tree girdling and cutting in tropical mangroves. PLoS One 9. https://doi.org/10.1371/journal.pone.0107868

Mcleod, E., Chmura, G.L., Bouillon, S., Salm, R., Björk, M., Duarte, C.M., Lovelock, C.E., Schlesinger, W.H., Silliman, B.R., 2011. A blueprint for blue carbon : toward an improved understanding of the role of vegetated coastal habitats in sequestering CO 2 In a nutshell : https://doi.org/10.1890/110004

Rideout, A.J.R., Joshi, N.P., Viergever, K.M., Huxham, M., Briers, R.A., 2013. Making predictions of mangrove deforestation: a comparison of two methods in Kenya. Glob. Chang. Biol. 19, 3493–501. https://doi.org/10.1111/gcb.12176

Slim, F., Gwada, P., Kodjo, M., Hemminga, M., 1996. Biomass and litterfall of Ceriops tagal and Rhizophora mucronata in the mangrove forest of Gazi Bay, Kenya. Mar. Freshw. Res. 47, 999. https://doi.org/10.1071/MF9960999

Tamooh, F., Huxham, M., Karachi, M., Mencuccini, M., Kairo, J.G., Kirui, B., 2008. Below-ground root yield

and distribution in natural and replanted mangrove forests at Gazi bay, Kenya. For. Ecol. Manage. 256, 1290–1297. https://doi.org/10.1016/j.foreco.2008.06.026

Annexes

Annex 1. List of key people involved with contact information

Name	Expertise	Institution	Contact details
Professor Mark Huxham	Mangrove ecology, lead author of project technical specification and project design document	Edinburgh Napier University / ACES	m.huxham@napier.ac.uk
Dr James Kairo	Mangrove restoration, Kenyan lead scientist	Kenya Marine and Fisheries Research Institute	gkairo@yahoo.com
Dr Martin Skov	Coastal ecology, lead scientist	Bangor University	mwskov@bangor.ac.uk
Ms Anne Wanjiru	Mikoko Pamoja Impact officer	Mikoko Pamoja Community Organisation	wanjiruanne31@yahoo.com

Annex 2. Information about funding sources

Financial support has been provided by Aviva Ltd.

Aviva Ltd Aviva is helping to fund mangrove carbon cycling research through the Earthwatch Tidal Forests of Kenya project. They have agreed to supply funding for

- Costs of initial fencing and planting Casuarina
- Costs of project validation
- A contribution towards the costs of the coordinator post

Whilst these initial secured contributions represent part of Aviva's current support for the mangrove conservation and research activities at Gazi, and are thus not contingent on secured carbon offsets in the future, Aviva do intend to be one of the organisations buying such offsets. The first two costs noted here are single payments; the final one will be met in future years through carbon finances

Annex 3. Producer/group agreement template

CONTRACT AGREEMENT

Contract Agreement between The Association for Coastal Ecosystem Services (ACES) and the Mikoko Pamoja Community Organization

---

Date …… Month …… Year ……

1. Preamble; Parties to the Agreement

Mikoko Pamoja Community Organization, hereinafter referred to as "MPCO", a designated Community Organisation, registered under the laws of the Republic of Kenya as a Community Based Organization (CBO) under the office of Gender and Social Development (ref. no DSS/MSAMB/DN/34/2012).

The Association for Coastal Ecosystem Services, "ACES", a charity registered Scottish Charitable Incorporated Organisation (SCIO. REG SC043978) under the laws of the Scottish Government.

This agreement concerns the initiation of a carbon based forest management project, involving forest conservation measures for the reduction of unsustainable and destructive forest use, and facilitating the instigation of long-term sequestration of carbon dioxide through community based management, implemented through a partnership between MPCO and ACES. Revenue generated by these activities will be used for social and environmental improvements for the people of Gazi Bay, including but not exclusively those in the villages of Gazi and Makongeni; these villages are subsequently referred to as the villages and this broader population is subsequently referred to as Gazi Bay people.

1. Objectives and Roles
The overall objectives of this contract are as follows:

a) To enable MPCO to generate revenue from the legal sale of carbon offsets, which are non timber forest products, to be used for the benefit and general economic and social development of the community.

b) To improve the environmental conditions and sustainability of natural resource uses in the Gazi Bay area, including in the villages of Gazi and Makongeni.

c) To reduce emissions of carbon dioxide and therefore contribute to global climate initiatives in line with Kenya's national policies.

d) To strengthen the sustainable management of mangrove forest according to the Kenya Forest Act 2005, the, subsequent acts and relevant village bylaws.

e) To reduce unsustainable forest use, destruction and degradation resulting from activities which are not in accordance with the approved and adopted land use plan.

f) To enable MPCO to derive revenue from the provision of ecosystem services in the form of carbon offsets through sustainable forest management.

1.1 Mutual and general responsibilities

a) All parties shall adhere to the Kenya Forest Act of 2005 and subsequent acts relating to forest protection and management in Kenya and conduct all activities according to the laws of the Republic of Kenya.

b) All parties shall, with due diligence, commit to work to minimize the transfer of activities that are contrary to the aims of the project, primarily the cutting of mangrove wood, to adjacent areas outside of the project area (a process known as leakage). Excessive leakage outside of the project area will result in reduced revenue for all parties.

c) All parties shall commit to monitoring how much carbon has been stored or lost within the project area.

d) All parties shall commit to monitoring the socioeconomic changes in and surrounding areas as a result of the initiative.

e) All parties may review and, when necessary, agree to adjust payments and expenditures as required to meet the aims of the project.

f) All parties shall take steps to ensure that village members and MPCO understand and know their responsibilities in relation to this project and are provided with the opportunity to participate.

1.2 The responsibilities of ACES

ACES shall hereby:

a) Work with local partners to help provide expert services, training and support to MPCO as necessary for successful joint implementation of the forest carbon project, including mapping, habitat assessment, measurement of carbon content, and other processes required by MPCO to meet their aims of sustainable forest management.

b) Secure appropriate buyers for the carbon stored in the project area as a result of the efforts of MPCO.

c) Compensate MPCO with the revenue generated from carbon sales, at a rate determined by the carbon market at the time, if conservation targets are met in accordance with the results-based payment plan. If targets are achieved, deposits to the MPCO Fund account will be made annually in accordance with the payment distribution plan.

d) Provide MPCO with financial reports annually.

1.3 The responsibilities of MPCO

MPCO shall hereby:

a) Ensure forest conservation through the implementation of the approved and adopted forest management plan, which protects the forest area for the benefit of all community members and future generations.

b) Diligently partner in forest conservation through improved forest management, monitoring, planting and enforcement activities in accordance with the forest management plan.

c) Take steps to ensure that village members understand and know their responsibilities in relation to this project and are provided with the opportunity to participate.

d) Refrain from selling carbon to any other person or entity in respect of the same forest area covered in the management plan.

2. Undertakings

MPCO shall ensure that any information provided to ACES under this agreement is truthful and accurate, and MPCO shall inform ACES of any valid changes resulting in reports that are no longer truthful or accurate. The undertakings by MPCO in order to ensure the good management and success of this project include:

a) MPCO shall partner faithfully in the project by meeting all requirements including the creation of any committee required by law for the purposes of managing the project area according to the community priorities and forest management plan.

b) MPCO agrees that the area of the forest demarcated for the purposes as shown in the land use plan remains protected for the period stated under the titled lease agreement(s).

c) MPCO agrees to partner with ACES to prevent any activities that contradict the forest use plan or national policies and laws including in the Forest Act 2005.

d) MPCO and ACES agree to work in accordance with the organisational structure as described in the Project Design Document. Kenya Marine and Fisheries Research Institute (KMFRI), as representative of the national government, will help to play an oversight role ensuring that all the activities outlined in this contract are implemented within the approved participatory forest management plan and in accordance with the laws of the Republic of Kenya.

3. Terms of Contract

3.1 Contract Validity

a) This contract will be implemented over a 20 (twenty) year period starting on the date of signing of this agreement and shall expire after this period of 20 (twenty) years.

b) The parties may renegotiate or amend this contract at any time upon agreement by all parties for the purposes of extending or reducing the contract's expiry date. However any valid amendment or renegotiation shall be effected in writing and through all parties appending their signatures.

3.2 Opting out or breaking the agreement

Should either party fail to meet their obligations as described in this agreement, the contract shall be considered invalid.

3.3 Amendments

This agreement can only be amended or improved in writing as shall be mutually agreed and through appending the signatures of all parties, ACES and MPCO.

3.4 Dispute resolution

In the event of any dispute that may arise between the parties in relation to this contract, all parties will meet to discuss how to resolve the dispute. If one party remains unsatisfied or if the parties fail to reach an agreement, they will refer their dispute to the Appeal and Complaints Committee. The Committee will be constituted of the following people:

v. One(1) representative from ACES
vi. One (1) representative from MPCO.
vii. One (1) elected representative from each of the villages participating in Mikoko Pamoja.
viii. Two (2) persons of appropriate qualifications and expertise chosen by both parties to represent them.

3.5 Issues beyond normal human control / force majeure

None of the parties to this contract shall be liable for any failure to perform its obligations where such failure is as a result of acts of nature including fire, flood, earthquake, storm, hurricane or other natural disaster, war, invasion, act of foreign enemies, hostilities (whether war is declared or not), civil war, rebellion, revolution, insurrection, military or usurped power or confiscation, terrorist activities, nationalisation, government sanction, blockage, embargo, labour dispute, strike, lockout or interruption or failure of electricity.

The party, MPCO or ACES, asserting force majeure as an excuse shall have the burden of proving that reasonable steps were taken (under the circumstances) to minimise delay or damages caused by the foreseeable events, that all non-excused obligations were substantially fulfilled, and that the other party was timely notified of the likelihood or actual occurrence which would justify such an assertion, so that other prudent precautions could be contemplated.

4. Sign Off.

This agreement is hereunder signed by both parties of this contract and so witnessed this…….. day in the month of ……. in the year …… and has been concluded in the Village of ……in the district of .....

A: On behalf of ACES

1. Name…….Position……. .
Signature……..

B. On behalf of MPCO

1) Name……. Position……..
Signature……

2) Name……. Position……..
Signature……

C. On behalf of KMFRI

1) Name……. Position……..
Signature……

D. Witnessed by

1. Name……..... Position……..
Signature…….....

2. Name……..... Position……..
Signature…….....

3. Name……..... Position……..
Signature…….....

Annex 4. Database template

Each year, the project will submit monitoring results to the Plan Vivo Foundation. The information will be presented according to the Plan Vivo reporting guidelines:

Plan Vivo Annual Report – Template Requirements 2011

Annex 5. Example forest management plans/*plan vivos*

The CFA management plan is available under the Mikoko Pamoja page on the ACES website at http://www.aces-org.co.uk/mikoko-pamoja-project/.

Annex 6. Permits and legal documentation

Formal registration of MPCO:

Certificate No. A434

Republic of Kenya

MINISTRY OF GENDER, CHILDREN & SOCIAL DEVELOPMENT

Certificate of Registration of Community Based Organization (CBO)

This is to Certify that

MIKOKO PAMOJA COMMUNITY BASED ORGANIZATION _ C.B.O.
Group Name

DSS/MSAMB/DN/A434/34/2012	MSAMBWENI	6/6/2012
Registration No.	Constituency	Date of Registration
GAZI	MSAMBWENI	KINONDO
Sub-location / Ward	District	Location
DIANI	is registered with the office of the District Gender & Social Development Officer (DGSDO) as a Community Based Organization (CBO)	MSAMBWENI
Division		District

OMANI M. WAZIRI
For: District Gender & Social Development Committee

6/6/2012
Date of Issue

Note: The Contents of this Certificate should not be erased, altered or defaced in any way.

Annex 7. Evidence of community participation

Communities have been heavily involved in designing activities. Full minutes and details of consultations are available on the Mikoko Pamoja section of the EAFPES website at www.eafpes.org

Annex 8. BioClimate Risk Buffer Tool

Managing risks of non-sustainability

BioClimate Research and Development

Version 2

08/04/2010

User inputs

	Risk type	Situation	Action	Timescale	Will it happen?		Severity		Score
A	Land Ownership/Tenure								0.075
A.1	Land tenure changed or disputed	Using community trust land	Ensure KFS agreement	Long	Unlikely	0.05	Low	1	0.05
A.3	Conflicting land-use interests	Others might want to use plantation sites	Ensure community agreement and involvement	Medium	Likely	0.1	Low	1	0.1
B	Financial								0.075
B.1	Project financial plan over-optimistic	Unable to meet community expectations	Be careful to communicate uncertainties. Secure more funding	Short	Unlikely	0.05	Low	1	0.05
B.2	Carbon price drops drastically	As above	As above	Short	Likely	0.1	Low	1	0.1
C	Technical								0.05
C.1	Insufficient technical capacity to monitor targets	Technical incompetence	Training of staff	Short	Unlikely	0.05	Low	1	0.05
D	Management								0.0625
D.1	Ineffective management	Reliant on management at a distance	Project managers and staff adequately trained, Kenyan managers on site	Short	Unlikely	0.05	Low	1	0.05

D.2	Poor record keeping		Robust procedures and keen oversight, record keeping part of job description	Short	Unlikely	0.05	Low	1	0.05
D.3	Staff with relevant skills and expertise		Careful selection of project staff and training	Short	Unlikely	0.05	Low	1	0.05
D.4	Tree damage from browsing	Cattle roaming in area	Maintain fence around Casuarina plantation and be vigilant for goat grazing at beach	Short	Likely	0.1	Low	1	0.1
E	Opportunity costs								0.05
E.1	Returns to community and stakeholder	Alternative opportunities become available	Development of business plan (reviewed periodically) for economically viable management, and expansion of project	Medium	Unlikely	0.05	Low	1	0.05
F	Political								0.05
F.1	Change in government policy over mangrove management			Medium	Unlikely	0.05	Low	1	0.05
G	Social								0.075
G.1	Disputes caused by conflict of project aims or activities with local communities or organisations	Multiple influences and stakeholders in the area	Participatory planning and continued stakeholder consultation over project lifetime	Short	Likely	0.1	Low	1	0.1
G.2	Major social unrest	Past history in the country of conflict	Involvement of all factions in the community. Use of site that was spared conflict in the past	Medium	Unlikely	0.05	Low	1	0.05
H	Fire, pests and disease								0.075
H.1	Incidence of tree crop failure from pests or disease	Sonneratia has been affected in past by moth infestation	monitoring of tree health. Planting noncontiguous areas	Short	Likely	0.1	Low	1	0.1

H.1	dry season fires affecting casuarina plantation	small fires quite common in dry season	maintain fire break around plantation	Long	Unlikely	0.05	Low	1	0.05
I	Physical								0.06667
I.1	Drought	Infrequent (<1 in 10 years)	mangroves unaffected. Could replant causarina trees	Short	Unlikely	0.05	Low	1	0.05
I.2	Hurricane	Infrequent (<1 in 10 years)	Replanting of trees as required	Short	Unlikely	0.05	Low	1	0.05
I.3	Floods	Infrequent (<1 in 10 years). El Nino events have caused die offs	use of protected areas away from forest fringes which are most affected	Short	Likely	0.1	Low	1	0.1
	Overall score (average of risk types)								0.06435
	Suggested risk buffer								11%